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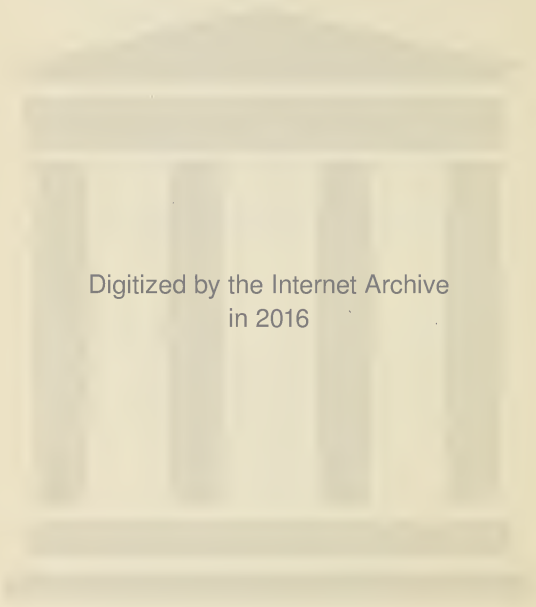
BOOK ONE

CURRICULUM

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MANUAL

TO ACCOMPANY

MATHEMATICS
for **EVERYDAY USE**

BOOK ONE

THE JOHN C. WINSTON CO., LIMITED
TORONTO

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INTRODUCTION

Before successful work can be done in any grade, the teacher must start with objectives and lay out a plan for instruction. If you will examine several courses of study, you will be impressed by the narrow views on the objectives of education. These objectives are often couched in terms of tradition and sentimentalism. The objectives must be viewed broadly. All the school can do is to sample the experiences of life. The teacher must make certain that the samplings are carefully chosen so that the pupil will make definite progress in accordance with the laws of learning. There can be no static concept of life in the learning process. The objectives need not be remote, but they may be considered as milestones to be reached and passed, only to find other objectives or milestones ahead. We must consider the growth of the child.

In this manual, it is planned to lay down some definite methods of procedure that have proved helpful when tried. At all times, the teacher must remember that her personality is more important than the method she uses. A problem we are facing today is the problem of the curriculum-directed teacher who does her work in a textbook-directed manner and has her work judged by the closeness with which she follows her instructions. As we recognize individual differences in pupils, so must we recognize individual differences in teachers.

Real progress in teaching will come when we find teachers individualizing, not only their own instruction, but the content as given to the pupil. Teachers must recognize that they are teaching boys and girls rather than a course of study. They must also realize that no two children in the classroom are exactly alike, and that the same method of instruction will not fit the needs of every child. The individual teacher must be quite concerned with the individual pupil. The mere setting up of a pattern is not sufficient. However, for the economy of time, we must generalize and lay down certain well-defined and well-proved methods of procedure.

Techniques are merely superficial aspects of teaching. Rousseau pointed out that while methods and techniques are important, the really important thing is the interest of the pupil. If you can interest your pupils, usually the rest will follow as a matter of course. If you solve your problem of interest, you solve your problem of discipline. Interest is the relationship between the particular pupil and the subject matter. Interest depends on the law of readiness. Kilpatrick says that to take interest in doing anything is to have a mind set toward it. It produces an inner urge to engage in that thing, and a readiness in sense and thought for whatever helps it along. In the following pages particular attention will be paid to direct and indirect methods of motivation, with special stress laid on self-competition as one of the most wholesome forms of motivation.

Today we are laying much stress on the importance of diagnostic and remedial teaching and on case study. The realization that the ability to add, subtract, multiply, and divide is an integration of many skills rather than

the mastering of a simple process, has opened up a very important field for investigation. If we know the various skills that make up a process and can diagnose and discover the weakness in a particular skill, we are able to apply remedial teaching. Our conventional treatment may be likened to that of a physician who prescribes without diagnosis; the results are often disastrous. Diagnostic and remedial teaching will be treated in some detail in the following pages.

The question of individual differences is an important one. In our treatment there are several things we can differentiate: 1. The curriculum. 2. The rate of progress. 3. The standard of attainment. 4. The purposes of instruction. 5. The methods of instruction.

There are two methods of handling the curriculum:

1. A plan of enrichment in which we give the minimum essentials to the slower pupils, and enrichment exercises to the brighter pupils. Three things must be watched:

a. Enrichment is not giving more of the same thing.

This is not what the brighter mind needs; it needs more difficult work to challenge the mental capacities of the learner.

b. Enrichment must not be interpreted to mean application. The pupil who needs more application is the dull one; the bright mind makes its own application.

c. Enrichment is not giving the minimum essentials to the dull pupils and an elaboration on these essentials to the brighter pupils. This is a reversal of what is needed. The brighter pupil can study from an outline; the duller pupil requires the completed structure.

You will note that we cannot enrich the fundamentals in arithmetic, but we *can* enrich the content by carefully chosen activities and projects.

2. A plan of rapid progress (acceleration). In one set-up all pupils get the same enrichment, and you care for individual differences by differentiated rates of progress. Skill subjects lend themselves to acceleration rather than to enrichment.

All educators admit the importance of considering the pupil as an individual in educating him. There is no simple pattern. No one method is applicable to all grades of children. In the following pages, methods for the enrichment of content and methods for acceleration will be outlined.

The activity movement is rapidly replacing the conventional treatment of subjects in the lower grades. This movement is rapidly gaining ground in the upper grades of the elementary school and also in the high school. Any absolutely new experience should be treated as an activity as far as possible. The activity makes things more meaningful. This method of gaining knowledge is slow and must be supplemented by observation and demonstration. This fundamental device is used widely in our conventional schools. Language as a process or aid to thought must be used to supplement observation, and must enable the brighter minds to grasp in a short time what it would take a long period of time to grasp by the activity method. In the following pages, activities and projects will be suggested when it is thought wise to use them.

The function of measurement in teaching is to know the child and his needs. Tests must be given for a

purpose. Testing is not an end in itself. One must bear in mind the value of educational tests—

1. To motivate the work of pupils by giving them a knowledge of their progress
2. To determine individual differences in the learning capacities of pupils, and then to use the results as a basis for instruction
3. To classify pupils according to achievement
4. As a guide to promotion
5. For assignment of grades
6. For purposes of diagnosis
7. To measure innate ability to do a certain kind of school work—a good measuring stick is one that measures accurately what it is intended to measure.

An important part of the testing programme is to be able to interpret the scores or marks correctly. There is a wide misuse of norms. It is more important to know that the pupil is working up to capacity than that he is up to standard or that the school is up to standard. A programme of remedial procedures should follow the interpretation of scores. Carefully prepared tests of various forms are provided.

The informational side of arithmetic is stressed in Grades VII, VIII, and IX. It is very important for the child to know how things are done in actual life situations. The problem must describe a life situation. The teacher, as leader, must attempt to translate the problem into the experience of the pupil. Psychology has shown us the futility of solving the problem for the child. The child must be led to do reflective thinking. Our aim is to produce a thinking boy or girl.

For many years, the conventional school has subdivided mathematical knowledge under these captions: arithmetic, algebra, and geometry. The aim of the new educational thought is to integrate subject-matter rather than to subdivide it. The words arithmetic, algebra, and geometry should disappear in the broader concept of unified mathematics. Arithmetic leads into algebra and geometry for many of its applications. The principles of arithmetic become the principles of algebra expressed with general numbers. The measurement of arithmetic becomes the specialized measurement of geometry.

This manual is prepared in order to interpret the textbook for the teacher, and to act as an aid and a guide in covering the year's work. It has been emphasized that at best we can only sample life situations. Since it is difficult to determine what are the minimum essentials for any given grade, it is better to cover a smaller body of material thoroughly than to spread your efforts over a large field. The sympathetic coöperation and support of all teachers is earnestly solicited by the educational authorities who have been responsible for the selection of this textbook. Especially is this support asked from experienced teachers who have been accustomed to more difficult types of problems than those treated in this textbook. Through simplicity of statement and reasoning, understanding and mastery will be attained.

The programme of diagnostic and remedial teaching is very much worth while. It should be started in Grade 1 and developed through the remaining grades. It is realized that there will be more bookkeeping to be done than formerly, but there will be the compensation that the problem is being attacked in a scientific manner.

SECTION 1

By the time the pupils reach Grade VII, they have progressed to widely varying levels of achievement. After the summer vacation, there is usually a large decrease in ability to perform computations, due to lack of use of the skills during that time. The authors of the textbook have planned the work in accordance with principles that grow out of the scientific study of the learning process.

The following steps are fundamentally sound and, if interpreted intelligently, will produce a much improved type of instruction.

1. The teacher should first give an inventory or survey test on the work of the previous grade to get a general picture of the status of the class. The test used should be a standardized one which has norms that enable the teacher to determine the relative status of the pupils in the class as compared with pupils of similar grades in general. (See Page 4 for survey test on fundamentals.)

2. Such general tests do not give adequate information for planning the remedial program and review work. More detailed information as to specific strengths and weaknesses is required. Such data can be secured by means of comprehensive diagnostic tests and exercises. (See Pages 6, 8, 10, 12, and 13 for practice in the fundamental processes.)

3. The teacher should use the results as the basis for assigning remedial work. Pupils may be grouped according to their needs, or the practice may be completely individualized by having each pupil work to overcome his specific weaknesses.

4. Retests should be given after a period of study and practice in order to determine the effectiveness of the work. (See Record of Practice Test Scores, Page 5.)

5. Such reteaching as may be necessary should be done.

6. In the case of pupils who fail to make satisfactory progress or who encounter learning difficulties, a careful diagnosis of the pupil's work should be made to determine causes of failure to improve.

7. Well planned remedial exercises should be assigned.

NOTE.—As far as possible, it seems desirable to devise techniques which will enable the pupil to diagnose his own deficiencies and to undertake a self-directed programme of improvement under the guidance of the teacher.

An important part of such a programme is the recording and graphing of practice test scores. (See Page 5.) It is essential that a comprehensive record of the pupil's mistakes and difficulties be recorded. Such added book-keeping is necessarily entering into the teaching of arithmetic. It is also essential that the pupil be conscious of his shortcomings and his progress at all times. The teacher may arrange to keep a notebook devoted entirely to arithmetic and to assign a page to each pupil. Here mistakes and difficulties may be recorded and crossed out only as they are corrected as a result of remedial teaching. The pupil should be encouraged to keep a similar record of his mistakes and corrections.

Such a recording of data should grow into a complete case study covering all phases of the child's life. Such a record is essential if educational and vocational guidance are to operate as important functions of the teacher in the senior grades of the elementary school and in the high school.

Pages 1 and 2.

The costs of an education as given in the textbook are average costs and serve the purpose for which they are given. Exercise 12 is to be considered as enrichment material and is to be given to the brighter pupils. The pupil can secure the required data from the annual report of his school district. Further information can be obtained from the Annual Report of the Department of Education. Using the information obtained, the pupil should follow the questions listed and compile information suitable for his own locality.

Page 3.

Pay particular attention to the instructions given on this page. Failure to follow them will defeat the purpose or plan of the authors.

Page 4.

Follow the instructions given at the bottom of the page. If, after the retest, the work is not yet up to standard, diagnostic work should be provided and then followed by remedial exercises. It must be remembered that the ability to add, subtract, multiply, or divide is not the mastery of a simple process but the integration of many skills. The trained teacher will recognize these skills and will test each of them until the deficiency is discovered.

For very weak pupils there are available specially prepared standard diagnostic tests and record blanks containing the most common faults of pupils in each of the four fundamental processes in whole numbers, fractions, and decimals. (*Diagnostic Tests and Practice Exercises in Arithmetic*, Grades VI, VII and VIII. The John C. Winston Company, Ltd., Toronto.) The addition combinations have been the most common source of mistakes. A simple technique can be used to detect such errors.

Example 1, Addition.

823 If the mistake is in the first column, break it up
486 into its separate parts, adding from the top down-
957 wards, or from the bottom upwards, in accordance
421 with the method followed by the pupil as:

738	3	9	16	17	25	34
529	6	7	1	8	9	5
445	—	—	—	—	—	—
—						

Treat columns 2 and 3 in a similar manner if necessary. Be careful to start with the carrying number.

A similar technique may be used in subtraction, multiplication, and division. Pupils should be encouraged to break up these exercises for themselves and to attempt to diagnose their own difficulties. This breaking-up process is helpful, in that it centers attention on the steps involved.

Many faults cannot be detected by test scores or by an analysis of the written work. They must be searched out by techniques that are more clinical in nature and too detailed to be treated in this manual. Such faults can be remedied only by pointed remedial teaching. For a complete treatment, refer to *Diagnostic and Remedial*

Teaching in Arithmetic, by L. J. Brueckner, The J. C. Winston Co., Limited, Toronto, Ont.

A. ADDITION OF WHOLE NUMBERS

1. ANALYSIS OF THE ADDITION PROCESS.

1. The 100 addition combinations.

2. Ability to apply the combinations to higher decades:

2	52
4	4
—	—

3. The meaning of the addition sign.

4. The meaning of the following terms: *Addition*, *sum*, *add*, *addend*, and *carrying*.

5. That in writing the example, units must be placed under units, tens under tens, etc.

6. That one must begin at the right and work to the left.

7. That unit figures should be added to unit figures in a column, tens to tens, etc. This also includes the ability to keep one's place in a column. 47

8. Ability to add a seen to a thought-of number: 56

After a pupil has added 3 and 6, he no longer sees 93
both of the numbers he is required to add. Now 7 is ..
a seen number, but 9 is only a thought-of number. —

This also includes the ability to keep in mind the result of each addition until the next number is added to it.

9. How to regard zeros in a column.

10. How to regard empty spaces in a column.

11. How to place the answer in the sum when a column has been added and the total sum of these figures is less than 10.

12. How to proceed with the next column when meeting the condition in 11.

13. How to place the answer in the sum when a column has been added and the sum of these figures is 10 or more.

14. How to proceed with the next column when meeting the condition in 13; i.e., carrying.

15. Ability to remember the number carried.

16. How to proceed when the need for carrying and no carrying is met alternately in an example.

17. How to place all the numbers in the sum.

18. How to check for correct answers.

B. SUBTRACTION OF WHOLE NUMBERS

1. ANALYSIS OF THE SUBTRACTION PROCESS.

One of the most difficult processes in arithmetic is subtraction. An analysis of the skills and knowledges needed in subtraction is as follows:

1. The 100 subtraction combinations.
2. Three ideas in one's subtraction concept:
 Taking away idea: $15 - 7$; 7 from 15.
 Adding idea: What number added to 7 equals 15?
 Difference idea: 15 is how many more than 7?
3. The meaning of the following terms: *Minus, less, subtrahend, minuend, borrowing, difference, remainder.*
4. The meaning of the subtraction sign.
5. That the complete minuend must always be larger than the complete subtrahend.
6. That in writing the example, units must be placed under units, tens under tens, etc.
7. That one must begin at the right and work to the left.
8. That the order of units in the subtrahend must be subtracted from the same order in the minuend.
9. How to proceed when the first number to be subtracted in the minuend is larger than the corresponding number in the subtrahend.
10. That one must not borrow unless the number in the subtrahend is larger than the corresponding number in the minuend.
11. How to proceed when a number of the subtrahend is larger than the corresponding number of minuend (borrowing.)
12. What it means to place a 1 in front of a number when borrowing ten.

$$\begin{array}{r} 423 \\ -219 \\ \hline \end{array}$$

13. What it does to the next number in the minuend when a 1 has been placed before the following number.

14. That one must be able to remember the new number made through borrowing.

$$\begin{array}{r} 628 \\ -239 \\ \hline \end{array}$$

After subtracting 9 from 18, the pupil is dealing with 11, not 12.

15. How to proceed when the need for borrowing and no borrowing is met alternately in an example.

16. How to borrow when two or more successive digits in the subtrahend are larger than the corresponding digits in the minuend.

17. How to proceed when there are fewer figures in the subtrahend than in the minuend.

18. How to proceed when the last subtraction takes place with the subtrahend and minuend the same:

$$\begin{array}{r} 649 \\ -623 \\ \hline \end{array}$$

(The zero must not be placed in the remainder.)

19. Ability to handle a zero or a succession of zeros in the subtrahend.

20. Ability to handle a zero or a succession of zeros in the minuend.

21. How to check for correct answers.

C. MULTIPLICATION OF WHOLE NUMBERS

1. BASIC KNOWLEDGE IN MULTIPLICATION.

The basic knowledge needed in multiplication is as follows:

1. The multiplication tables through 9×9 including zeros.

2. How to add.

3. The meaning of the multiplication sign.

4. The meaning of the following terms: *Multiplication, product, multiplicand, multiplier, carrying, and sum.*

5. That in writing the example, units must be placed under units, tens under tens, etc.

6. That the multiplier is always a number of *times*.

7. That the number in the multiplicand is to be multiplied by the numbers in the multiplier.

8. That one must begin at the right and work to the left.

9. How to place the product after the first multiplication when the product is less than 10.

10. Ability to proceed with the multiplication of the next digit when meeting the condition in 9.

11. How to place the answer in the product when the product is 10 or more than 10.

12. How to proceed with the multiplication of the next digit when meeting the condition in 11; i.e., *carrying*.

13. Ability to multiply and add quickly.

14. Ability to remember the number carried.

15. Ability to handle zero or a succession of zeros in the multiplicand.

16. How to proceed when the need for carrying and no carrying are met alternately in the example.

17. How to proceed after the multiplication by the units figure of the multiplier is completed when there is more than one figure in the multiplier.

(a) Which number to multiply by next.

(b) Where to place the first product.

18. Ability to handle a zero or a succession of zeros in the multiplier.

19. That these products must be added and how this is done. This involves any or all of the 18 points on addition.

20. How to check for correct answers.

D. DIVISION OF WHOLE NUMBERS

1. THE KNOWLEDGE NEEDED IN SHORT DIVISION.

The basic knowledge and abilities necessary in short division:

1. The multiplication tables through 9×9 including zeros.

2. The 100 subtraction combinations.

3. The division tables through the 9's including zeros.

4. The meaning of the signs for division, $\overline{)}$, and $\div$.

5. The meaning and use of each of the following terms: *Division, product, dividend, carrying, divisor, quotient, remainder*.

6. How to proceed when the first number of the dividend is the same as, or greater than, the divisor.

7. Where to place the first number of the quotient when meeting the condition in 6.

8. How to proceed when the first number of the dividend is smaller than the divisor, as : $4\overline{)104}$.

9. Where to place the first number in the quotient when meeting the condition in 8.

10. Each step:
 - (a) Divide.
 - (b) Place quotient figure.
 - (c) Multiply.
 - (d) Subtract.
 - (e) Carry.
11. How to handle the remainder after subtracting: $2\overline{)9154}$.
12. Ability to remember the number carried.
13. That no number equal to or larger than the divisor can be carried.
14. Ability to find the correct quotient figure with a minimum of trial; i.e., rapid recognition of the two factors, one being given.
15. How to continue dividing after some number in the quotient brings no remainder: $\begin{array}{r} 18 \\ 2\overline{)364} \end{array}$
16. Ability to handle the zero in the quotient and make the proper operation in the dividend: $\begin{array}{r} 150 \\ 4\overline{)6012} \end{array}$
17. Ability to handle the zero in the dividend when alone or used with a number carried.
18. How to handle a zero or a number of zeros at the end of the dividend.
19. How to place correctly all quotient figures.
20. How to handle the remainder at the end of a problem that does not "come out even."
21. How to check for correct answers.

2. THE ADDITIONAL BASIC KNOWLEDGE NEEDED IN LONG DIVISION.

In addition to the knowledge listed for short division, the following knowledge is basic in the long division process:

1. Ability to subtract under conditions found in the long division process.
2. Ability to estimate quotients of all types, chiefly in examples with two- and three-place divisors.
3. How to multiply and carry.
4. The steps in the process.
 - (1) Divide.
 - (2) Place quotient figure correctly.

- (3) Multiply divisor and correct quotient figure.
- (4) Place the resulting product correctly.
- (5) Compare with number from which it is being subtracted.
- (6) Subtract.
- (7) Compare remainder and divisor.
- (8) Bring down digit from dividend.
- (9) Continue these steps until the example is completed.

Page 5.

When the work of the diagnostic test has been completed, the teacher should carefully analyze and summarize the findings. These should be recorded on the pages of a notebook in which records of diagnosis are kept. Reteaching and remedial work should then be provided in the light of the findings of the diagnosis.

Page 6.

Diagnostic work, similar to that described on page 4, can be done on pages 6, 8, 10, 12, and 13, if necessary.

Page 7.

As enrichment exercises for the brighter minds, assign the writing of a short descriptive paragraph about each tool in the list on this page.

Page 9.

If it is necessary to read the numbers on this page, be sure to omit *and* as (exercise 2), "three million, six hundred eighty-four thousand, seven hundred twenty-three." The word *and* is reserved to mark the decimal fraction from the whole number, and also the common fraction from the whole number in a mixed number; 342.6 is read "three hundred forty-two *and* six tenths." $3\frac{1}{2}$ is read, "three *and* one half."

As enrichment material, have the pupils bring to school newspapers and magazines containing statistical material that uses large numbers. Various uses can be made of such material in geography, history, and arithmetic.

Page 11.

Several activities should grow out of these exercises:

1. Measure an acre on the school grounds (approximately $69\frac{1}{2}$ yards square) and place a stick at each corner so that the pupils can visualize the area.
2. In one corner of the acre, measure a square rod.
3. Complete exercises 11 and 12 as enrichment material.

Page 14.

It is not the amount of experience in solving problems that counts, but the amount of carefully organized experience. The teacher, as leader, must translate the problem into the experience of the pupil. The following steps are suggested:

1. Silent reading to discover unknown words, as, *average*, *$\frac{1}{4}$ -off sale*, *running foot*, and to visualize the setting of the problem.
2. Oral reading for understanding. A problem read with understanding is already half solved.
3. Dramatization or graphing may be necessary.
4. State the operation or operations required in correct order.
5. Estimate the answer.
6. Solve the problem.
7. Check all work.

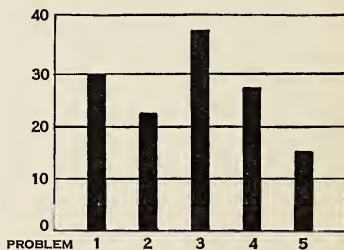
In solving a problem, it is necessary that the statements be complete enough to be readily understood. Since computational errors should be diagnosed, the computations should be shown along with the statements. The following plan is suggested:

Divide the sheet into two sections by a perpendicular line. Direct the pupil to solve the problem as shown here:

STATEMENT	COMPUTATIONS
<i>Problem 1.</i>	
John's height today..... $51\frac{1}{4}$ "	$51\frac{1}{4}$ $50\frac{5}{4}$
John's height one year ago..... $49\frac{1}{2}$ "	$-49\frac{2}{4}$ $49\frac{2}{4}$
Difference..... $1\frac{3}{4}$ "	$\frac{1}{4} \times \frac{1}{12} = \frac{1}{48}$
Average..... $\frac{1\frac{3}{4}}{12} = \frac{7}{48}$ "	

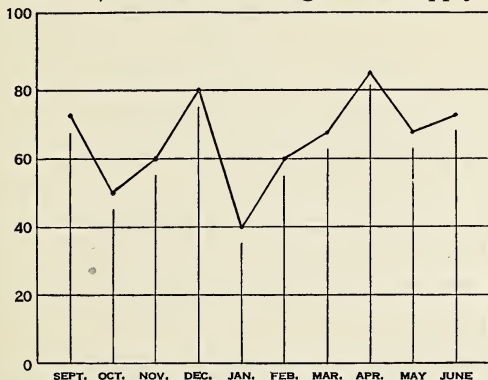
At the end of the period, record the success or failure of the effort in a manner similar to the graph below.

As problem 5 was solved by only 15 pupils out of 40, diagnostic and remedial work should be provided on this problem first. Follow with problem 2, 4, 1, and 3 as far as time permits. Later in the year, the graph may be made on a per cent basis.



Each pupil should keep a record of his daily progress, either as a fraction ($\frac{3}{5}$) or as a per cent (60%). At the end of the month, an average is computed and graphed as shown. Both teacher and pupil should be much concerned with the months of October and January which may show a decided drop in marks. The register may show that John has missed several days of school;

outside interests may have caused a break in his work. The teacher may discover a lack of proper gradation in her own work, or a failure to diagnose and apply remedial



teaching with a consequent lack of understanding on the part of the pupil. If you are graphing accuracy, remember that a pupil who is accurate in September will likely be accurate in October. If for some reason he drops to fair or poor, look for the reason in your gradation of the work.

Self-competition is the most wholesome form of motivation. Urge a pupil to surpass his own record rather than the record of one of his classmates. It is more important for all to know that he is working up to capacity than that he is excelling one of his classmates. With our present understanding of individual differences in pupils, it is unfair to publish class marks or to grade them as to their standing in the class. The achievement of the individual pupil in relationship to his capacity is the true measure of progress.

Page 16.

Follow a procedure with fractions similar to that outlined for the four fundamentals. On pages 21, 23, 26, and 30, you will find the Brueckner Tests in Fractions for addition, subtraction, multiplication, and division. The examples contained in these diagnostic tests are the important types that should be included in the practice materials. They contain, in various combinations, all of the skills listed under specific abilities. The function of these tests is not to measure ability, but to make it possible for the teacher to inventory the complete area of each process and to locate the types of examples which may be presenting difficulty for the class or for any individual pupil.

(a) **Specific abilities involved in addition of fractions.** The following list of items arrays the various new skills involved in the addition of fractions:

SKILL NO.**DESCRIPTION OF SKILL**

- (1) 1. Knowledge that fractions must have a common denominator before they are to be added.
- (2) 2. Knowledge that to find the sum of two or more like fractions, their numerators are to be added and their sum written over the common denominator.
3. Ability to reduce unlike fractions to a common denominator:
- (3) (a) When the common denominator is one of the given denominators: $\frac{1}{2} + \frac{1}{4} = \frac{3}{4}$; $4\frac{1}{3} + \frac{1}{6} = 4\frac{1}{2}$.
- (4) (b) When a common denominator is the product of given denominators: $\frac{1}{2} + \frac{1}{3} = \frac{5}{6}$; $2\frac{1}{4} + 3\frac{1}{3} = 5\frac{7}{12}$.
4. Knowledge of procedure to use in:
- (5) (a) Adding like fractions.
- (6) (b) Adding unlike fractions.
- (7) (c) Adding whole numbers and fractions.
- (8) (d) Adding whole and mixed numbers.

SKILL No.

DESCRIPTION OF SKILL

- (9) (e) Adding fractions and mixed number (all types of fractions).
- (10) (f) Adding two or more mixed numbers (all types of fractions).
5. Ability to reduce sums to simplest form:
- (11) (a) Ability to recognize answer already in simplest form.
- (12) (b) Ability to reduce proper fractions: $\frac{4}{6} = \frac{2}{3}$;
 $\frac{8}{12} = \frac{2}{3}$.
- (13) (c) Ability to reduce improper fractions:
- (1) Simple reduction, answer a mixed number:
 $\frac{11}{5} = 2\frac{1}{5}$.
- (14) (2) Simple reduction, answer a whole number:
 $\frac{8}{4} = 2$; $\frac{2}{2} = 1$.
- (15) (3) Further reduction, answer a mixed number:
 $\frac{12}{8} = 1\frac{4}{8} = 1\frac{1}{2}$; $\frac{18}{4} = 4\frac{2}{4} = 4\frac{1}{2}$.
- (d) Ability to reduce mixed numbers:
- (16) (1) No reduction required: $9\frac{1}{3} + 7\frac{1}{4} = 16\frac{7}{12}$.
- (17) (2) Simple reduction: $12\frac{4}{8} = 12\frac{1}{2}$; $16\frac{6}{12} = 16\frac{1}{2}$.
- (18) (3) Carrying, answer a whole number: $12\frac{8}{4} = 14$.
- (19) (4) Carrying, simple reduction, answer a mixed number: $7\frac{9}{2} = 11\frac{1}{2}$.
- (20) (5) Carrying, further reduction, answer a mixed number: $7\frac{8}{8} = 8\frac{2}{8} = 8\frac{1}{4}$.

How to use the list of skills in analyzing an example:

This list of items may be used in making an analysis of the skills involved in working such an example as the following:

$$\begin{array}{r} 7\frac{1}{2} = 7\frac{2}{4} \\ 8\frac{3}{4} = 8\frac{3}{4} \\ \hline 15\frac{5}{4} = 15 + 1\frac{1}{4} = 16\frac{1}{4} \end{array}$$

The skills involved in this example are skills 1, 2, 3, 10, 13, 19, described in the list above.

The skills involved in working the following examples differ from those listed for the above example, as can be determined by a comparison of the skills indicated.

- (1) $7\frac{3}{4}$ Skills required are (2) $8\frac{1}{3}$ Skills required are
 $\frac{3}{4}$ Nos. 1, 2, 9, 15, 20. $\frac{6}{4}$ Nos. 1, 2, 4, 10, 16.
 $8\frac{1}{2}$ $14\frac{7}{12}$

(b) **Specific abilities involved in subtraction of fractions.**
The following is a list of the specific skills involved in the subtraction of fractions:

SKILL No.

DESCRIPTION OF SKILL

- (1) 1. Knowledge that fractions must have a common denominator before they can be subtracted.
- (2) 2. Knowledge that numerators of like fractions are to be subtracted and the difference written over the common denominator.
3. Ability to reduce unlike fractions to a common denominator:
- (3) (a) When common denominator is one of the given denominators: $\frac{1}{2} - \frac{1}{4} = \frac{2}{4} - \frac{1}{4} = \frac{1}{4}$;
 $4\frac{1}{2} - 3\frac{1}{4} = 4\frac{2}{4} - 3\frac{1}{4} = 1\frac{1}{4}$.
- (4) (b) When common denominator is the product of given denominators: $\frac{1}{4} - \frac{1}{5} = \frac{1}{20}$;
 $3\frac{1}{3} - \frac{1}{8} = 3\frac{5}{24}$.
4. Ability to use procedure in subtracting fractions and mixed numbers, not involving borrowing, in—
- (5) (a) Subtracting like fractions: $\frac{8}{8} - \frac{3}{8} = \frac{5}{8}$;
 $\frac{3}{4} - \frac{1}{4} = \frac{1}{2}$.
- (6) (b) Subtracting unlike fractions: $\frac{7}{8} - \frac{1}{6} = \frac{17}{24}$.
- (7) (c) Subtracting fractions from mixed numbers, no zero difficulty: $3\frac{1}{4} - \frac{1}{8} = 3\frac{1}{8}$.
- (8) (d) Subtracting two mixed numbers, no zero difficulty: $5\frac{1}{2} - 2\frac{1}{4} = 3\frac{1}{4}$.
- (9) (e) Special types of zero difficulties with—
 - (1) Answer a proper fraction, zero not expressed:
 $7\frac{1}{2} - 7\frac{1}{4} = \frac{1}{4}$.
 - (2) Answer a whole number, zero not expressed:
 $7\frac{1}{8} - 3\frac{1}{8} = 4$; $4\frac{2}{3} - \frac{2}{3} = 4$.
 - (3) Answer is zero, and zero is expressed:
 $\frac{1}{8} - \frac{1}{8} = 0$; $7\frac{1}{8} - 7\frac{1}{8} = 0$.
5. Ability to subtract a whole number from a mixed number:
- (12) (a) Knowledge that a fraction less zero gives the original fraction.
- (13) (b) No zero difficulty: $4\frac{1}{2} - 2 = 2\frac{1}{2}$.
- (14) (c) Zero difficulty, zero not expressed: $4\frac{1}{2} - 4 = \frac{1}{2}$.
6. Ability to use procedure in subtracting fractions

SKILL NO.

DESCRIPTION OF SKILL

and mixed numbers from whole numbers, which involves borrowing—

- (15) (a) When whole number is unit (1):
 $1 - \frac{3}{4} = \frac{4}{4} - \frac{3}{4} = \frac{1}{4}$.
- (16) (b) When whole number is greater than one, no zero difficulty: $7 - \frac{3}{4} = 6\frac{4}{4} - \frac{3}{4} = 6\frac{1}{4}$;
 $8 - 4\frac{1}{4} = 7\frac{4}{4} - 4\frac{1}{4} = 3\frac{3}{4}$.
- (17) (c) When whole number is greater than one, zero difficulty, zero not expressed:
 $8 - 7\frac{1}{2} = 7\frac{2}{2} - 7\frac{1}{2} = \frac{1}{2}$.

7. Ability to use procedure in subtracting fractions and mixed numbers from mixed numbers, which involves borrowing:

- (18) (a) Ability to change the form of the minuend in examples containing like fractions: $7\frac{1}{4} - \frac{3}{4} = 6\frac{5}{4} - \frac{3}{4} = 6\frac{1}{2}$; $7\frac{1}{8} - 2\frac{3}{8} = 6\frac{9}{8} - 2\frac{3}{8} = 4\frac{3}{4}$.
- (19) (b) Ability to change the form of the minuend in examples containing unlike fractions:
 $6\frac{1}{2} - \frac{3}{4} = 6\frac{2}{4} - \frac{3}{4} = 5\frac{6}{4} - \frac{3}{4} = 5\frac{3}{4}$.

NOTE.—After the form of the minuend in 6 and 7 is changed, the skills listed under 4 become operative.

8. Ability to reduce answers to simplest form:

- (20) (a) Ability to recognize answers already in simplest form.
- (21) (b) Ability to reduce proper fractions to lowest terms:
 $\frac{2}{4} = \frac{1}{2}$.
- (22) (c) Ability to reduce mixed numbers to simplest form:
 $4\frac{2}{4} = 4\frac{1}{2}$.
- (23) (d) Knowledge that fraction with 0 numerator equals zero: $\frac{1}{8} - \frac{1}{8} = \frac{0}{8} = 0$.

This list of skills may be used in making an analysis of the skills involved in any example in subtracting fractions. The following examples illustrate the method:

$$\begin{array}{r} (1) \quad 7\frac{1}{2} = 7\frac{2}{4} \quad \text{Skills required are} \\ - \frac{1}{4} = \frac{1}{4} \quad \text{Nos. 1, 2, 3, 7, 20.} \\ \hline 7\frac{1}{4} \end{array}$$

$$\begin{array}{r} (2) \quad 8\frac{1}{6} = 8\frac{1}{6} = 7\frac{7}{6} \quad \text{Skills required are} \\ - 7\frac{2}{3} = 7\frac{4}{6} = 7\frac{4}{6} \quad \text{Nos. 1, 2, 3, 19, 9, 21.} \\ \hline \frac{3}{6} = \frac{1}{2} \end{array}$$

(c) **Specific abilities involved in multiplication of fractions.**
The following list of items arrays the unit skills involved in multiplication of fractions:

SKILL No.

DESCRIPTION OF SKILL

- (1) 1. Knowledge that fractions need not be reduced to a common denominator before multiplying.
- (2) 2. Knowledge that "of" means "times," as in $\frac{1}{2}$ of 4.
- (3) 3. Knowledge that the product of the numerators gives the numerator of the answer and that the product of the denominators gives the denominator of the answer.
- (4) 4. Ability to reduce mixed numbers to improper fractions: $7\frac{1}{2} = \frac{15}{2}$.
- (5) 5. Knowledge that a whole number, as 4, may be expressed with a denominator, as $\frac{4}{1}$.
6. Ability to apply procedure to use in—
 - (6) (a) Multiplying proper fractions, with unit numerators: $\frac{1}{4} \times \frac{1}{8} = \frac{1}{32}$.
 - (7) (b) Multiplying proper fractions with greater than unit numerators: $\frac{3}{4} \times \frac{5}{7} = \frac{15}{28}$.
 - (8) (c) Multiplying proper fractions and whole numbers: $\frac{1}{4} \times 4 = 1$.
 - (9) (d) Multiplying proper fractions and mixed numbers: $4\frac{2}{3} \times 1\frac{1}{4} = \frac{5}{6}$.
 - (10) (e) Multiplying whole and mixed numbers: $4 \times 7\frac{7}{8} = 31\frac{1}{2}$.
 - (11) (f) Multiplying mixed numbers: $4\frac{1}{2} \times 4\frac{2}{3} = 21$.
7. Ability to express products in simplest form (if cancellation is not used), when product is expressed as—
 - (a) Proper fraction.
 - (12) (1) Reducible: $\frac{3}{6} = \frac{1}{2}$.
 - (13) (2) Irreducible: $\frac{2}{3}$.
 - (b) Improper fraction, which gives—
 - (14) (1) Product a whole number: $\frac{12}{4} = 3$; $\frac{4}{4} = 1$.
 - (15) (2) Product a mixed number, simple reduction: $\frac{12}{5} = 2\frac{2}{5}$.
 - (16) (3) Product a mixed number, involving further reduction: $\frac{18}{8} = 2\frac{3}{8} = 2\frac{1}{4}$.
8. Ability to cancel, which involves—
 - (17) (a) Ability to determine when cancellation is not possible.

SKILL No.

DESCRIPTION OF SKILL

- (18) (b) Ability to recognize common factors.
(c) Ability to indicate cancellation in numerator and denominator.

(19) (1) Single cancellation: $\frac{2}{3} \times \frac{1}{3} = \frac{2}{9}$.

(20) (2) Double cancellation: $\frac{\cancel{3}^1}{\cancel{8}_4} \times \frac{\cancel{10}^5}{\cancel{21}_7} = \frac{5}{28}$

- (21) (d) Ability to manipulate unit terms remaining after complete cancellation:

$$\frac{\cancel{1}}{\cancel{3}} \times \frac{\cancel{3}}{\cancel{2}} = \frac{1}{2}; \frac{\cancel{1}}{\cancel{2}} \times \frac{\cancel{2}}{\cancel{1}} = \frac{1}{1} = 1.$$

NOTE.—Cancellation is merely a short-cut method of reduction before the respective multiplications have been made. It should probably not be taught until the basic procedure has been firmly established. Otherwise interference with important habits may result in serious difficulty.

The skills involved in solving typical examples in the multiplication of fractions are analyzed below:

(1) $7\frac{1}{4} \times 2\frac{2}{3} = \frac{29}{\cancel{4}_1} \times \frac{\cancel{2}}{3} = \frac{58}{3} = 19\frac{1}{3}$. Skills required are Nos. 1, 3, 4, 11, 15, 18, 19.

(2) $\frac{4}{5} \times 8 = \frac{32}{5} = 6\frac{2}{5}$. Skills involved are 1, 3, 5, 15, 17.

(d) **Specific abilities involved in division of fractions.** The following list of items arrays the skills involved in division of fractions. It is assumed that the method of inversion is used.

SKILL No.

DESCRIPTION OF SKILL

- (1) 1. The knowledge that the divisor must be inverted as the important new step in a division example.
(2) 2. Knowledge that a whole number such as 4 may be thought of as having the denominator 1, thus $\frac{4}{1}$;
 $\frac{2}{3} \div 4 = \frac{2}{3} \div \frac{4}{1} = \frac{2}{3} \times \frac{1}{4} = \frac{1}{6}$; $4 \div \frac{1}{3} = \frac{4}{1} \times \frac{3}{1} = 12$.
(3) 3. Ability to reduce a mixed number to an improper fraction: $4\frac{1}{2} = \frac{9}{2}$.

SKILL No.

DESCRIPTION OF SKILL

- (4) 4. Knowledge that mixed numbers should almost always first be reduced to improper fractions: $2\frac{1}{2} \div 1\frac{1}{4} = \frac{5}{2} \div \frac{5}{4} = 2$.
- (5) 5. Knowledge that after the divisor is inverted the procedure is the same as in an example in multiplication of fractions, thus involving many of the specific skills and knowledges listed for that process.
6. The ability to invert the divisor when it is—
- (6) (a) A proper fraction: $\div \frac{1}{2} = \times \frac{2}{1}$; $\div \frac{4}{5} = \times \frac{5}{4}$.
- (7) (b) An integer: $\div 4 = \times \frac{1}{4}$.
- (8) (c) A mixed number: $\div 2\frac{1}{2} = \div \frac{5}{2} = \times \frac{2}{5}$.
7. After the divisor is inverted, the example involves the ability to work an example in which—
- (9) (a) An integer is multiplied by a proper or an improper fraction: $5 \div \frac{2}{3} = 5 \times \frac{3}{2}$; $5 \div 2\frac{1}{2} = 5 \div \frac{5}{2} = 5 \times \frac{2}{5}$.
- (10) (b) A proper or an improper fraction is multiplied by a proper or an improper fraction: $\frac{2}{3} \div \frac{3}{5} = \frac{2}{3} \times \frac{5}{3}$; $2\frac{1}{2} \div 4 = \frac{5}{2} \times \frac{1}{4}$; $2\frac{1}{2} \div \frac{1}{2} = \frac{5}{2} \times \frac{2}{1}$.
- (11) 8. Ability to cancel when the form has been changed to a multiplication example. See skills listed under multiplication.
9. Ability to reduce the answer to the simplest form involving—
- (12) (a) Ability to recognize fractions already reduced to lowest terms.
- (13) (b) Ability to reduce proper fractions to lowest terms.
- (c) Ability to reduce improper fractions to simplest form:
- (14) (1) As a whole number: $\frac{4}{2} = 2$.
- (15) (2) As a mixed number, no second reduction: $\frac{9}{8} = 1\frac{1}{8}$.
- (16) (3) As a mixed number, involving further reduction: $1\frac{9}{8} = 1\frac{3}{2} = 1\frac{1}{4}$.

The following illustrate the analysis of skills involved in three typical examples in division of fractions.

(1) $5 \div 2\frac{1}{2} =$ Skills in division, 1, 2, 3, 4, 5, 8, 9, 11, 14.

$$\frac{\cancel{5}}{1} \times \frac{2}{\cancel{2}} = \frac{2}{1} = 2$$

(2) $5 \div 7\frac{1}{2} =$ Skills in division, 1, 2, 3, 4, 5, 8, 9, 11, 12.

$$\frac{\cancel{5}}{1} \times \frac{2}{\cancel{15}_3} = \frac{2}{3}$$

(3) $5 \div 3\frac{3}{4} =$ Skills in division, 1, 2, 3, 4, 5, 8, 9, 11, 15.

$$\frac{\cancel{5}}{1} \times \frac{4}{\cancel{15}_3} = \frac{4}{3} = 1\frac{1}{3}$$

Page 22.

Modern educators conceive subject matter as a series of experiences. These experiences are so much a part of the child that we call them activities. An activity is a purposeful act that meets the needs and interests of the pupil. It is not the amount of experience that educates, but the amount of carefully planned experience; hence an activity should involve planning. The pupil should participate actively in the experience even if the participation is only mental. To be of value, the product of the activity should be judged.

In the manual is introduced a number of projects and activities. The aim is to have the pupil not merely receptive, but also active as far as possible. The projects suggested are addressed to the pupil.

Project 1:

Testing your powers in athletics.

In the following events, make a record of your attainment and then try to improve it:

1. Standing broad jump.
2. Running broad jump.
3. High jump.

4. Running 50 yards.
5. Climbing a twelve-foot rope against time.
6. Throwing a baseball at a target for accuracy.
Make a target 6' $\times$ 6' and mark it into three circles. Count 3 for the inner, 2 for the middle, and 1 for the outer circle. Stand back 25 feet and throw 25 times.
7. Foul shooting: shooting with the basketball for accuracy (25 shots).
8. Shots per minute (you are given a one-minute period to see how often you can put the ball into the basket).
9. Throwing a basketball (or football) for distance.
10. Shot put. (10-lb. or 12-lb. shot.)

It is better to strive to improve your own record than to attempt to equal or excel the record of one of your schoolmates.

Enrichment Material.

The brighter minds that are experiencing no difficulty should be allowed to explore new fields of endeavour. The Olympic Games held at Amsterdam in 1928 and at Los Angeles in 1932 offer an abundance of work similar to that on page 22, but in a new setting and with enrichment of content.

1. Find the meaning of the Olympic Games, and of the various terms: broad jump, running high jump, pole vault, hurdles, hammer throw, shot put, marathon race. In Alberta, have the pupils refer to *Number Highways 6*, page 93.

2. Have the pupils construct a table of events and records for:

- (a) The Olympic Games of 1932.
- (b) The Empire Games in London, England,
August 4th to 11th, 1934.

Page 25.

As enrichment material, have the pupils bring to school advertisements from newspapers, and assist them to construct problems for themselves from these sources. Let them exchange problems for solution. These exercises should be varied to conform to the types found on this page.

Page 27.

As enrichment material, have the pupils draw a plan of the farm and locate the total area in pasture, hay, silage, oats, and barley, and the area each in hay, silage, oats, and barley. It is suggested that a rectangle 10" by 12" be drawn and squared into 120 square inches. Let each square equal 1 acre. If a smaller rectangle is desirable, draw to scale.

Page 28.

Ratio is sometimes defined as the quotient resulting when two numbers are compared by division. Ratio expresses relations between like numbers only, as feet and feet, bushels and bushels. This relation, or the ratio of one number to another, is often written as a fraction and is always reduced to its lowest terms. The ratio of 6 to 8 is $\frac{6}{8}$, or $\frac{3}{4}$.

A pupil will be able to solve problems better and more quickly if he learns to compare numbers and quantities, and to see what part one quantity is of another. Exercises like the following will be of value.

Example 1.

Tom has \$1.50

Mary has \$5.00

John has \$2.50

Nora has \$7.50

Supply the missing words and numbers:

1. Nora has..... more than John.
2. Nora has..... times as much as John.
3. Mary has..... times as much as Tom.
4. Nora has..... times as much as Tom.
5. John has..... times as much as Nora.

Example 2.

Copy and supply the missing numbers to show the recipe as used by Mrs. A and as used by Mrs. B.

Hawaiian Punch

<i>Standard Recipe</i>		<i>As used by Mrs. A</i>	<i>As used by Mrs. B</i>
Cold water	6 cups	8 cups	4 cups
Pineapple juice	$7\frac{1}{2}$ cups	.....	.....
Orange juice	$2\frac{1}{4}$ cups	.....	.....
Lemon juice	$1\frac{1}{2}$ cups	.....	.....
Raspberry syrup	9 tablespoons	.....	.....

Example 3.

Peggy wanted to plant some tulip bulbs in her garden. To fill up the patch of ground evenly, she had to have 18 bulbs. If a dozen bulbs cost 84¢, how much will she have to pay for 18 bulbs?

Ans. \$1.26.*Example 4.*

A factory machine can make 900 pins in 3 minutes. How long will it take to make 2,100 pins at the same rate?

Ans. 7 min.

Page 31.

In Alberta, if the pupil has difficulty, refer to *Number Highways 6*, pages 102 to 110, and for supplementary or review problems to page 107. A similar procedure can be followed in Manitoba, using the assigned textbook. Further work on volume or rectangular solids will be found on pages 167-171 of this textbook.

Page 33.

Tests on a single process are necessary and helpful in diagnosing difficulties. Tests in which the processes are worked in miscellaneous order should be given at intervals. These test the ability of the pupil to make the adaptation from one process to another, and might be listed as power tests. Accuracy, rather than speed, should be the aim of the teacher. Remember that accuracy is fostered by:

1. Neatness of work.
2. A careful listing of habitual type errors.
3. An absence of mental or emotional disturbance.
4. A feeling of confidence.
5. Constant checking of results.

NOTE.—Much time is squandered in going over matter which pupils already know. Too often energy is not concentrated upon the particular difficulties that should be attacked.

Self-competition is a most helpful form of motivation. Keep the following question constantly in mind: *Is the pupil working up to his capacity?*

Page 34.

It is wise to emphasize the fact that very little progress was made in mathematical reasoning, and in what we

call higher mathematics, until the decimal system was revised to include place value to the right of the decimal point. We are living in a machine age, an age demanding precision in measurement for standardization of parts. This necessity for exactness is causing the common fraction to have less and less use as the decimal fraction grows in importance.

In reading decimals, the word *and* is the key word for the insertion of the decimal point. Read 346.25 as "three hundred forty-six *and* twenty-five hundredths." It is not wise to continue the reading of decimals indefinitely in this manner. In life, 346.25 would be read "three four six point two five," or, "three forty-six point twenty-five." When you are sure that place value is mastered, use the simpler method of reading decimals. Exercises in the following order are helpful:

1. Powers of 10. $10 = 10$ $100 = 10 \times 10$ $1,000 = 10 \times 10 \times 10$.
2. Writing numbers in extended form.
 $346 = 3 \times 100 + 4 \times 10 + 6 \times 1$.
3. Some teachers find it helpful to treat the decimal as follows: $346.25 = 3 \times 100 + 4 \times 10 + 6 \times 1 + 2 \times \frac{1}{10} + 5 \times \frac{1}{100}$.

NOTE.—1. Make certain that the full significance of the decimal point is appreciated. In the early grades, pupils associate the decimal point with money; hence they get the idea that 2.45 has no meaning unless \$ is placed in front of it.

2. Pupils have no feeling of assurance that 3 is the same as 3. or 3.0; also, 0.24 confuses them as to its meaning.

3. Many errors are due to misspelling when pupils are asked to express decimals in words, the chief errors being the use of *hundreds* for hundredths, and *thousands* for thousandths.

Page 35.

Exercise 9.

Here the *position* of the decimal point determines the value. To the pupil, 5.9 and .59 may look alike; it is the position of the decimal point that makes the one quantity $5\frac{9}{10}$ and the other $\frac{59}{100}$. Drill on the facts in paragraph 1, page 34.

(a) To determine relative value, quantities may be expressed as common fractions or mixed numbers:

$$5\frac{9}{10}, \frac{59}{100}, \frac{59}{1000}, \frac{59}{1}, \frac{590}{1}.$$

(b) If necessary, change to a common denominator:

$$\frac{59}{100} = \frac{590}{1000}$$

(c) Or, an arrangement of the quantities in column form, with all decimal points directly in line, will help to determine value:

$$\left\{ \begin{array}{l} 5.9 \\ .59 \\ .059 \\ 59. \\ 590. \end{array} \right.$$

NOTE.—It will be necessary to caution pupils that

(a) The *number* of digits does not indicate the value of the quantity. For example, .8 is greater in value than .3954.

(b) The *value* of the digits at the left determine the value of the quantity. For example, .835 has a greater value than .339; and .3899 is less in value than 41.

Exercise 10.

"In 1876 Mr. Melvil Dewey, late New York State Librarian, devised and published a decimal plan for the classification of books in libraries. By this system the field of knowledge is divided into nine main classes, numbered 1 to 9, general works being assigned to a tenth numbered 0. Each class is similarly subdivided into ten divisions, each division into ten sections, and so on decimally as far as may be needed. Subjects are arranged in simple numerical order, constituting a class list which brings books on the same subject together on the shelves, and in the card catalogue as well, with books on cognate subjects in the immediate vicinity." (Nelson's Encyclopædia.)

Exercises 11, 12, and 13.

Our system of weights and measures has had an historical, rather than a logical development. The one exception is our money system which is the only decimal system of units in common use in Canada. The only logical system of weights and measures based on the decimal system is the metric system which will be taught in Grade VIII.

Have the pupils write the tables of weight, length, and time on a piece of paper to see whether the units are arranged on the basis of tens or tenths.

Exercise 14.

Nearly all the great nations with the exception of Great Britain and India have accepted the so-called decimal system of currency. In a perfect system there would be no breaks or interpolations, but the actual

currencies described as "decimal" do not show this rigid symmetry. Popular convenience has compelled a departure from the strict decimal form.

- (a) The pupils will have no trouble with Canadian or United States currency.
- (b) France: The standard unit is the *franc*; it is equal to 100 *centimes*. There are 10-franc and 100-franc pieces, and a 10-centime piece. Besides these, there are 50-franc, 20-franc, 5-franc, and 2-franc pieces, as well as 50- and 20-centime pieces.
- (c) Japan: The standard unit is the *yen*; 100 *sen* equal 1 yen. There are 20-yen, 10-yen, and 5-yen pieces; also there are 50-sen, 20-sen, and 10-sen pieces.
- (d) Denmark: The standard unit is the *krone*; 100 *öre* equal 1 krone. There are 20-kroner, 10-kroner, 2-kroner and 1-krone pieces; also 50-öre, 40-öre, 25-öre and 10-öre pieces.
- (e) Great Britain: The standard unit is the *pound*. There are 4 *farthings* in 1 *penny*; 12 *pence* in 1 *shilling*; 20 shillings in 1 pound.
- (f) India: The standard unit is the *rupee*. There are 3 *pie* in 1 *pice*; 4 *pice* in 1 *anna*; 16 annas in 1 rupee; 15 rupees in 1 *pound*.

Pages 36 and 37.

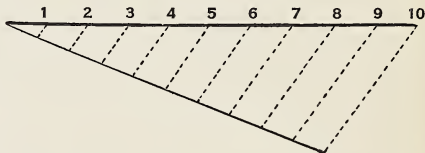
More practice should be given in changing common fractions to decimal fractions than in the reverse process. Decimals are becoming much more important in life than are common fractions or mixed numbers. Pupils must be prepared for the usual and practical life activities.

Page 38.

Exercise 8.

The construction of a decimal foot is done on a geometrical principle that will be learned in Grade IX under similar triangles. There is no reason why a Grade VII pupil should not use the principle.

Draw a horizontal line 12" long. At any acute angle, draw a line 10" long to join the original line at one of the terminals.



Divide the 10-inch line into 1" sections. Join the open ends of these two lines, and at each division on the 10" line, draw a line parallel to the line joining the open ends. You will find that the 12" line has been divided into 10 equal parts. An object that is as long as 7 divisions on this decimal foot is $\frac{7}{10}$ or .7 feet long.

In a similar way a foot long line may be divided into 5, 7, 8, or any number of parts.

Sometimes it is necessary to divide each inch into tenths to find .74 of a foot, for example. The same procedure can be followed. Use a line 1" long and another 10 divisions (inches if you like) at an acute angle to it. Follow the directions given. An object that is as long as 7 divisions and 4 smaller divisions in the next space to the right is $\frac{74}{100}$ or .74 feet long.

Enrichment Material.

1. Have the pupils construct a conversion scale that will convert measurements in feet and inches to decimals of a foot. Make the scale 1 yard long

and divide each foot into tenths, and each inch into tenths. Tack this scale on the wall. Convert by using dividers as outlined on page 124.

2. Ask the pupils to make a list of as many ways as they can, in which the decimal system is encroaching on our system of measurement. Study the financial page in a newspaper.

(a) A stop watch registers 10.3 seconds.

(b) The speedometer of a car registers 25.4 miles. See page 40.

(c) Mileage on a railway time-table or on an automobile road map. See page 97.

(d) Rainfall measurement. See page 53.

(e) A quart of milk weighs 2.58 pounds. See page 98.

Pages 39, 43, and 52.

These tests in addition, subtraction, multiplication, and division are diagnostic in that each test contains a wide variety of types of examples involving different skills, or presents special kinds of difficulties. The results of these tests make it possible to sample the entire series of skills in each process in decimals.

NOTE.—Pupils are given as much time as they need to work the examples in these tests.

Since decimals are but an extension of the decimal system, the skills involved in addition, subtraction, multiplication, and division of integers are the skills involved in addition, subtraction, multiplication, and division of decimals. The new difficulties found in decimals and not in integers all center around the manipulation of the decimal point. The chief sources of error in decimal manipulation are found on the following page.

1. *In Addition:*

- (a) The incorrect placement of the decimal point in the sum.
- (b) The failure to keep like place value under like place value.

2. *In Subtraction:*

- (a) Lack of control over the procedure to follow when borrowing is needed.
- (b) The incorrect placement of the subtrahend in such examples as "subtract .5 from .75," due to the lack of understanding of the place value of the decimal system.

3. *In Multiplication:*

The following illustrate typical errors:

- (a) $4 \times .02 = .8$ Omission of the necessary zero.
- (b) $5 \times .03 = .015$ Insertion of an unnecessary zero.
- (c) $6 \times .36 = 216$ Omission of decimal point.
- (d) $5 \times .3 = .15$ Incorrect placing of decimal point.

4. *In Division:*

- (a) The decimal point in the wrong place.
- (b) Faulty placement of zeros.
- (c) Omission of the decimal point.

Page 40.

As enrichment material, have the pupils secure an automobile road map, on which distances between towns are listed as decimals (e.g. 12.6 mi.). Assume a speedometer reading with which to start from some particular town, and check the speedometer reading for each town

on the route you take. By adding the distance between the towns, calculate the distances which you have travelled.

Project 2:

Transportation.

Railways haul about 97% of the freight in Canada, and the motor trucks 3%. The railroad carries most of the long, heavy haul, such as raw material, mineral, agricultural, forest, and animal products. The truck specializes on the short-haul manufactured product.

According to figures published in *The Railway Age*, it costs \$.0016 to transport 100 pounds a mile by truck and 14¢ to pick it up and deliver it. (These costs will vary under adverse conditions).

Use a road map and calculate the cost of transporting freight, including pick up and delivery charges, from some near-by center, such as Vancouver, Calgary, or Winnipeg to your nearest town.

What would enter into the costs stated above?

What arguments are there in favor of the truck? the railroad?

Page 44.

In Alberta, refer to *Number Highways 6*, page 65, for previous work on this topic.

Page 46.

When you multiply any number by 100, 1000, etc., you are using factorial multiplication.

$$136 \times 100 = 136 \times 10 \times 10 = 13600.$$

Factorial multiplication often leads to a very worthwhile short cut.

$$(a) 246 \times 12 = 246 \times 3 \times 4 = 2952$$

$ \begin{array}{r} 2476 \\ 624 \\ \hline 14856 \\ 59424 \\ \hline 1545024 \end{array} $	$ \begin{array}{r} 6 \times 2476 \\ 4 \times 14856 \\ \hline \end{array} $	$ \begin{array}{r} 2476 \\ 600 \\ \hline 1485600 \end{array} $	$ \begin{array}{r} 2476 \\ 24 \\ \hline 9904 \\ 4952 \\ \hline 59424 \end{array} $
---	--	---	--

If one number in the multiplier is a factor of another number, as 6 is a factor of 24, multiply by the factor of the larger number and place the right hand digit of the partial product under the digit used as multiplier. Instead of multiplying by the multiple, multiply the first partial product by the number of times the factor goes into its multiple and place the right hand digit of this partial product under the right hand digit of the multiple. This procedure insures proper place value, as:

$ \begin{array}{r} 36 \div 6 = 6 \\ 72 \div 36 = 2 \end{array} $	$ \begin{array}{r} 123456 \\ 72636 \\ \hline 740736 \\ 4444416 \\ 8888832 \\ \hline 8967350016 \end{array} $	$ \begin{array}{r} 6 \times 123456 \\ 6 \times 740736 \\ 2 \times 4444416 \\ \hline 72636 \times 123456 \end{array} $
---	---	---

When you divide numbers by 100, 1000, etc., you are using factorial division.

$$976 \div 100 = 9\frac{76}{100} = 9.76$$

$$\begin{array}{r}
 9 - 7 \\
 10 \overline{)97 - 6} \\
 10 \overline{)976}
 \end{array}$$

When you divide 10 into 976, you get 97 groups of ten and 6 units remaining. When you divide 97 by 10, you get 9 groups of one hundred and 7 groups of ten remaining. Therefore, you get 9 groups of one hundred and $7 \times 10 + 6$ or 76 remaining.

Many teachers use this method when the divisor can be readily factored. A worth-while short cut should be used whenever zeros occur to the right in the divisor; cross out the zeros and also cross out a corresponding number of digits at the right of the dividend. Complete the division, and to the last difference affix the digits crossed out in the dividend as shown, to get the complete remainder. The following is the working by factorial division:

$$\begin{array}{r}
 28 \\
 28\cancel{00})\cancel{7}86\cancel{45} \\
 \underline{56} \\
 226 \\
 \underline{224} \\
 245
 \end{array}$$

$$\begin{array}{r}
 28 \text{ rem. } 2 \\
 28\overline{)786} \text{ rem. } 45 \\
 100\overline{)78645}
 \end{array}$$

or 28 groups of 2800 and $2 \times 100 + 45$, or 245 remaining.

Page 48.

The use of the caret ($\wedge$) instead of shifting the decimal point in divisor and dividend should be followed in all the work in division of decimals.

Check:

1. In working the example first select the partial dividend. Place the first quotient figure directly over the right hand digit of the first partial dividend. There must be a digit in the quotient above each digit in the dividend to the right of the first quotient figure. This controls the zero difficulty in the quotient.
2. Multiply the quotient by the divisor and add the remainder, if any, and you get the dividend. Insert the decimal point as you would in the multiplication of decimals.

Page 51.

Special Practice with Hundredths.

Be careful to label the quotient correctly. Think through the exercise in this manner:

$$.25 \overline{) \$75} = \frac{\$75}{.25} = \frac{\$7500}{25} = \$300$$

or if $\frac{1}{4}$ of a group is \$75, the whole is \$300.

Pages 52 and 53.

Supplementary Material.

1. The meteorological record (page 37) was made at the Olds School of Agriculture, Alberta. Similar records for any year may be obtained from your nearest Dominion Experimental Station, or from any Dominion Meteorological Station. Have the pupils construct a similar table from a recent year and make monthly comparisons. Have them attempt to interpret the data.

2. Ten inches of snow are equal to 1 inch of rainfall. Find the rainfall equivalent to 39 inches of freshly fallen snow.
Ans. 3.9 inches.

3. It is stated that 300 pounds of water are necessary to raise 1 pound of dry matter. In a tree that weighed 98 pounds, it was found that 16.66 lb. was dry matter. How much water was used to form the dry matter?
Ans. 4998 lb.

4. After a 2.3 inch rainfall, the loss by surface run-off was .4 in.; the loss by evaporation the first week was .29 in. How many inches of this rainfall were still in the soil after a week?
Ans. 1.61 inches

PRECIPITATION RECORDS AT OLDS SCHOOL OF AGRICULTURE

1928	Temperature				Precipitation			Average per month for 15 years	Total hours of sunshine	Evaporation in inches
	Maximum	Date	Minimum	Date	Mean	Rain-fall	Snow-fall	Total		
January.....	53	9	-34	1	20.9	....	4.00	.40	125.9	....
February.....	53	9	-18	21	23.4	....	8.00	.80	158.8	....
March.....	65	20	-5	7	28.0	....	6.00	.60	146.9	....
April.....	76	27	7	11	32.9	....	16.75	1.67	145.6	....
May.....	85	25	24	2	54.6	.87	....	.87	318.1	4.73
June.....	77	27	35	6	52.8	8.91	....	8.91	198.8	2.52
July.....	86	24	39	16	59.3	1.41	....	1.41	288.7	3.60
August.....	85	10	34	13	55.3	2.67	....	2.67	253.9	2.63
September.....	82	3	20	25	50.3	.30	....	.30	241.5	3.05
October.....	65	6	6	30	36.2	.08	.70	.15	160.0	....
November.....	64	3	9	14	31.8	....	.20	.02	144.3	....
December.....	55	23	-21	2	23.7	....	2.00	.20	97.0	....
Total for year..	..	..	....	..	....	14.24	37.65	18.00	2279.5	16.53

Page 57.

Problem Scale 1.

It is desirable to know not only the rate and the accuracy with which a pupil can work examples of a certain type, but also the level of his progress in the subject.

Scales differ from the rate tests in two respects: (1) the time limits for the tests are so liberal that each pupil is given practically as much time as he needs to complete all the examples or problems on the test; (2) the examples in the scale are arranged in the order of difficulty from very easy types, on which few pupils fail, to those which only a few pupils can work correctly. The difficulty

has been determined by the proportion of pupils who can work the examples or problems correctly. In theory, a score on a scale indicates the level of difficulty at which a pupil is able to work an example or problem correctly. The ability of a pupil at a particular level can be found by giving him tests, made up of examples or problems similar to the elements at that level, and finding the rate of work and accuracy.

NOTE.—Problem scales are repeated on pages 120, 178, 191, and 224. These scales make possible repeated measurement at intervals during the year. If desired, similar scales may be constructed by the teacher to make possible a continuous inventory of the progress; such tests may well be given at least once a month during the year. Be sure to record the level of attainment of each pupil as each problem-scale test is given.

The problem scale is also a check on the level of difficulty of the regular problems being given to the pupils to be solved. Place your problem alongside your scales until you find a problem that corresponds in difficulty. The place this problem occupies in the series of ten problems will give you its degree of difficulty.

Roman Numerals.

NOTE.—This section is to be included as a part of the Grade VII course.

A knowledge of Roman Numerals is necessary today for three purposes:

1. To tell time.
2. To read chapter numbers in books.
3. To read dates on corner stones.

The symbols in the Roman notation as it is used today are as follows:

I represents one	L represents fifty
V represents five	C represents one hundred
X represents ten	D represents five hundred
M represents one thousand.	

The manipulation of these symbols follows certain well-defined principles.

1. Numbers are written from left to right as in our decimal system of notation.
2. Repeating a symbol repeats its value: III for 3, XX for 20, CCC for 300. The symbols V, L, D are never repeated. Why?
3. When a symbol of lesser value is placed *after* a symbol of greater value, their values are added: VI = 6, XV = 15.
4. When a symbol of lesser value is placed *before* a symbol of greater value, the lesser is subtracted from the greater value: IV = 4, XL = 40.
5. When a bar is drawn over a symbol or group of symbols, it multiplies the value by 1000: $\overline{\text{IV}}$ = 4000, not 4; $\overline{\text{V}}$ = 5000, not 5. This principle illustrates the confusion caused by teachers and pupils who draw a line above and below a symbol.

Give practice in reading and writing Roman numerals. It is wise to break up the numbers for the pupil, as: CXXXVII = 100 + 30 + 7, CCCXLIX = 300 + 40 + 9, MCMXXXV = 1000 + 900 + 30 + 5.

Page 57.

Section 1 constitutes a comprehensive review of the work of Grade VI. Before leaving this section, a power

test that covers the work of this section should be given. The following tests are offered as suitable for this purpose:

A. *Abstract Exercises.* Solve the following:

$$\begin{array}{r} 1. \ 875 \\ 876 \\ 594 \\ 783 \\ \hline 655 \end{array}$$

$$\begin{array}{r} 2. \ 98002 \\ -79163 \\ \hline \end{array}$$

$$\begin{array}{r} 3. \ 587 \\ \times 908 \\ \hline \end{array}$$

$$4. \ 468 \overline{)444600}$$

$$5. \ 8\frac{7}{8} + 9\frac{5}{8} + 6\frac{3}{4} =$$

$$6. \ 24\frac{4}{5} - 16\frac{9}{10} =$$

$$7. \ 9\frac{1}{2} \times 27 =$$

$$8. \ 4\frac{1}{8} \div 2\frac{1}{16} =$$

$$9. \ 1.8 + 1.75 + 23.7 =$$

$$10. \ 36.5 - 2.75 =$$

$$11. \ 3.75 \times 9.84 =$$

$$12. \ 13.892 \div 46 =$$

$$13. \text{ Change } \frac{7}{12} \text{ to a three-place decimal.}$$

$$14. \ 33\frac{1}{3} \times 891 =$$

$$15. \ 12\frac{1}{2} \times 96 =$$

$$16. \ 16\frac{2}{3} \times 120 =$$

$$17. \ 2000 \div 66\frac{2}{3} =$$

$$18. \text{ Change } .37\frac{1}{2} \text{ to a common fraction.}$$

$$19. \text{ Change } 3.25 \text{ to a mixed number.}$$

$$20. \text{ Arrange these numbers in the order of their value, writing the largest number first: } 6.89, 7.0, .091, 64.5, 970.$$

B. *Completion Exercises.*

Fill each blank with the correct answer:

1. The answer of an example is called the *sum*.
2. The difference between two numbers is always smaller than the
3. Multiplication is a short form of
4. Division is a short form of
5. The value of a decimal is not changed by a zero to the right of the decimal.
6. You can both terms of a fraction by the same number without changing the value of the fraction.
7. Average is found when you the sum by the number of addends.

8. Annexing a zero to a whole number
the whole number by 10.
9. In division, each remainder must always be
..... than the divisor.
10. 6 is said to be a of 24.
11. When adding or subtracting unlike fractions,
change the fractions so that they will have the
same.....
12. To reduce fractions to lowest terms, divide each
part by a
13. In the example $\frac{3}{4}$ of 12, "of" means
14. In $\frac{2}{3} \div \frac{3}{4} = \frac{2}{3} \times \frac{4}{3}$ we say that we have
the divisor.
15. One tenth of a cent, or a mill, is of
a dollar.
16. When two numbers are compared by division,
their is found.
17. In expressing dimensions, as $3'' \times 4'' \times 12''$, the
sign $\times$ is read
18. When reading decimals, the word
designates the decimal point.
19. To divide by 25, multiply by and
divide by
20. When we measure the distance around the school
grounds, we find the

C. Multiple Choice Exercises.

Select the correct answer in each group:

1. Select the number most likely to be the correct
product of 18×27 :
250 366 486 595
2. The decimal .060 is (a) equal to .06, (b) greater
than .06, (c) less than .06.
3. The United States gallon measure (or wine
measure) is
(a) Larger than the Imperial gallon which is
used in Canada.

- (b) The same size as the Imperial gallon used in Canada.
- (c) Smaller than the Imperial gallon of Canada.
- 4. Multiplying the numerator of a fraction by a whole number
 - (a) Decreases the value of a fraction.
 - (b) Increases the value of a fraction.
 - (c) Does not change the value of a fraction.
- 5. To the right of the decimal point the digits are called
 - (a) Units, tens, hundreds, thousands, etc.
 - (b) Tenths, hundredths, thousandths, etc.
 - (c) Units, tenths, hundredths, thousandths, etc.
- 6. Things are usually cheaper
 - (a) When sold in sets.
 - (b) When sold one piece at a time.
 - (c) When sold on credit or time.
- 7. If the denominator of a fraction is divided by any number,
 - (a) The value of the fraction is multiplied by that number.
 - (b) The value of the fraction is not changed.
 - (c) The value of the fraction is divided by that number.
- 8. I might need to find the product of 27.3 and 19.7 in
 - (a) Estimating distance.
 - (b) Measuring area.
 - (c) Finding an average.
- 9. A short way of multiplying by $12\frac{1}{2}$ is to
 - (a) Divide by 8.
 - (b) Multiply by 8.
 - (c) Multiply by 100 and divide by 8.
 - (d) Multiply by 8 and point off 2 places.
- 10. I might need to divide 132.6 by 14 when
 - (a) Measuring yard goods.
 - (b) Finding an average.
 - (c) Checking the total of a bill.

D. True-False Exercises.

Write "T" for *true* or "F" for *false* before each statement:

1. In division, the quotient is always less than the dividend.
2. In subtraction, you always take the smaller digit from the larger digit.
3. If you add or subtract the same number from the dividend and the divisor, the quotient will remain the same.
4. You may add two fractions by adding the numerators and the denominators.
5. Multiplication is a short method of adding equal addends.
6. If you multiply the quotient by the divisor and add the remainder, if any, you get the dividend.
7. Inserting a zero in a decimal between the point and the figures, multiplies the decimal by 10.
8. Prefixing a zero to a whole number, multiplies the whole number by 10.
9. The reciprocal of a fraction is a fraction with its terms interchanged.
10. Two numbers may be compared by subtraction.

E. Matching Exercises.

In each blank, write the number of the correct answer from the list at the right:

- | | | |
|---------------------------|-------|--------------------|
| 1. 1 Imperial gallon | ..... | 1. 1 cu. ft. |
| 2. 1 rod | ..... | 2. 160 sq. rods. |
| 3. $6\frac{1}{4}$ gallons | ..... | 3. 60 pounds. |
| 4. 1 sq. yd. | ..... | 4. 277.274 cu. in. |
| 5. 1 acre | ..... | 5. 9 sq. ft. |
| 6. 1 section | ..... | 6. 1760 yd. |
| 7. 1 bu. wheat | ..... | 7. 16.5 ft. |
| 8. 1 mile | ..... | 8. 144 sq. in. |
| 9. 1 sq. ft. | ..... | 9. 62.5 lb. |
| 10. 1 cu. ft. of water | ..... | 10. 640 acres. |

F. Problems.

Solve the following problems:

1. A schoolroom should have 15 sq. ft. of floor space for each pupil. How many pupils will a room 24 ft. by 35 ft. accommodate under these conditions?
2. At 40 cents a pound for candy and 5 cents each for boxes, what is the cost of 6 half-pound boxes of candy?
3. How many blouse lengths of $2\frac{1}{2}$ yards each can be cut from 20 yards of cloth?
4. If 520 rods of fence are required to inclose a rectangular field measuring 100 rods in width, what is the length of the field?
5. Allowing $1\frac{1}{4}$ cu. ft. to a bushel, how many bushels of potatoes may be stored in a bin 8 ft. by 6 ft. by 10 ft.?
6. A line $\frac{1}{4}$ of an inch on a map in Lucy's book represents 5 miles. What area is represented on the map by a rectangle $1\frac{3}{4}$ inches by $1\frac{1}{4}$ inches?
7. An automobile travelled 32.4 miles in 1 hour and 15 minutes. What was the average number of miles an hour travelled?
8. What is the value of a farm $\frac{1}{2}$ mile long and $\frac{1}{4}$ mile wide at \$125 an acre?
9. Butter costs \$.54 a pound package and \$.29 a half-pound package. How much do you save by buying 10 pounds of butter in pound packages?
10. Mr. Crow's milk tested 4.5 pounds of butterfat a hundred. How much will he receive for the butterfat in 2000 pounds of milk if he is paid \$.48 a pound?

Key to tests

- A.* 1. 3,783 2. 18,839 3. 532,996 4. 950
 5. $25\frac{1}{4}$ 6. $7\frac{9}{10}$ 7. $256\frac{1}{2}$ 8. 2
 9. 27.25 10. 33.75 11. 369,000 12. .302
 13. .583 14. 29,700 15. 1,200 16. 2,000
 17. 30 18. $\frac{3}{8}$ 19. $3\frac{1}{4}$
 20. 970 64.5 7.0 6.89 .091
- B.* 1. addition 2. minuend
 3. addition 4. subtraction
 5. affixing (adding) 6. multiply
 7. divide 8. multiplies
 9. less 10. factor
 11. denominator 12. common factor
 13. times 14. inverted
 15. $\frac{1}{1000}$ or one thousandth 16. ratio
 17. by 18. and
 19. 4, 100 20. perimeter
- C.* 1. 486. 2. *a.* 3. *c.* 4. *b.* 5. *b.* 6. *a.* 7. *a.*
 8. *b.* 9. *c.* 10. *b.*
- D.* 1. T. 2. F. 3. F. 4. F. 5. T. 6. T. 7. F.
 8. F. 9. T. 10. T.
- E.* 1. 4. 2. 7. 3. 1. 4. 5. 5. 2. 6. 10. 7. 3.
 8. 6. 9. 8. 10. 9.
- F.* 1. 56 pupils 2. \$1.50 3. 8 lengths
 4. 160 rods 5. 384 bu. 6. 875 sq. miles
 7. 25.92 miles 8. \$10,000 9. 40 cents
 10. \$43.20

SECTION II

A financial budget corresponds to the plan of the builder. A definite plan is just as essential in the saving and investing of money as in the construction of a house. Spending and saving are largely matters of habit, and they are habits that can be readily formed. Saving and thrift merely imply the practice of good judgment in buying. Nothing is a bargain, regardless of price, if it does not render a service commensurate with its cost.

It is a good practice to keep a record of your expenditures over a period of time, and then to compare the various items and the totals with the income earned. If you find that you are spending too much, a careful scrutiny of your accounts will reveal the items that can stand pruning.

Pages 58 to 60.

A necessary part of any scheme of budgeting is the keeping of accounts. The method used on pages 58 and 59 is simple but effective. Notice that the emphasis is on "live within your income." These lessons will be of little value unless the pupils put the theory into practice. The following are some suggested accounts on which to work:

1. The cost of school supplies for the year.
2. The cost (estimated per item) of raising a calf, colt,

or pig for one year with a consequent return at market prices.

3. The cost of feeding hens with the consequent return from eggs.
4. The treasurer of a Sunday School or of some club.
5. A record of the income and outgo of the home for a week or a month.

Enrichment Material.

1. The following is an actual record of the cost of raising *two* calves to breeding age ($18\frac{3}{4}$ months).

Initial weight of calves at birth (average)...	70 lb.
Final weight of calves.....	945 lb.
Gain.....	875 lb.

Feed consumed and costs:

Whole milk, 1100 lb. @ \$1.50 per cwt.....	\$16.50
Skim milk, 8874 lb. @ 20¢ per cwt.....	17.75
Alfalfa, 673 lb. @ \$18 per ton.....	6.06
Sheaf green feed, 1494 lb. @ \$6.00 per ton..	4.48
Silage, 3051 lb. @ \$5.00 per ton.....	7.63
Hay, 124 lb. @ \$15 per ton.....	.93
Oat chop, 1452 lb. @ 40¢ per bushel.....	17.08
Wheat bran, 721 lb. @ \$32 per ton.....	11.54
Oilcake meal, 32.5 lb. @ \$48 per ton.....	.78

\$82.75

Five months' pasture for two heifers @ \$1 per head per mo.	\$10.00
---	---------

Total cost.....	\$92.75
Average cost per head.....	\$46.38
The selling price was \$5.75 per cwt.	

Record the above data on a form to indicate "Income" and "Outgo."

2. Ask the pupils to look up the sales and prices of cattle, hogs, eggs, cream, and milk, in the daily newspaper and to make a report on them for the class.
3. Ask the pupils to make a household account for one week, using the following, or similar data:

May 15.	Cash on hand.....	\$6.00
	Allowance for week	40.00
Put away for	{ rent.....	\$10.00
	{ groceries.....	3.40
	{ butcher.....	1.90
	{ shoes.....	5.00
	{ dress.....	7.50
	{ miscellaneous expenses..	4.20

The historical background to money and banks will tend to give an intrinsic interest to the topic. Before the advent of money, men used barter. In an attempt to standardize barter, the Greeks made oxen a measure of value. Various other media of exchange have been used, such as shells, beaver skins, blankets, tobacco, and finally, metals. Metals gained in favor because of their ease of transportation, and in some cases, because of their rarity, hence inherent value. At first they were weighed, and from that we get the English "pound." Later they were stamped with the weight. Today our English coinage is measured against standardized weights of gold and silver.

From the Italian word *banco* comes the English word bank. Banco means a bench. The Lombards were exchangers of money and used benches erected in the market place. In 1694 the Bank of England was established to lend financial backing to King William for his war with France.

In Canada, following the systems of barter established by law, we find the issue in 1685 by the French colony of fiat paper money. From 1812 to 1814, in order to meet the expenses of the war, fiat money for which the credit of Great Britain was pledged, was issued. The first bank was created in Lower Canada in 1817. After tentative legislation during 1867 and 1870, the first general Bank Act of the new Dominion of Canada was passed in 1871.

Enrichment Material.

1. Have the pupils learn as much as they can about the power vested in banks by the Bank Act.

(a) Charters of all banks are renewable for only ten years.

(b) There must be a capital of \$500,000, with \$250,000 deposited with the Minister of Finance.

(c) Double liability of shareholders.

(d) Note-issuing power.

(e) Bank Circulation Redemption Fund.

(f) The Finance Act of 1914.

Besides making more elastic the use of emergency circulation, this Act suspended the redemption in gold of Dominion notes.

After the war Canada returned to the gold standard, but the Finance Act has been invoked, and as it operates by proclamation, it is no longer possible to secure payment in gold on demand, nor is it possible to secure gold for export except on the authority of the Minister of Finance.

2. Arrange for the pupils to learn about the new Central Bank of Canada and also about the legislation that limits the note-issuing power of all other banks.

Page 63.

Give practice in writing cheques. This is essentially a lesson in composition. Since cheques are considered as money, people are often tempted to forge or raise them. The following rules make dishonest practices difficult:

1. Use pen and ink; never use a pencil.
2. Number cheques and stubs consecutively as issued.
3. Completely cover all blank spaces with words, figures, or wavelike lines.
4. Write in a clear, legible hand the name of the person to whom the cheque is made out.
5. Enter the amount in figures close to the dollar sign, the cents smaller than the dollars. Be sure you have sufficient funds in the bank. Never overdraw.
6. Write the amount in words, beginning at the extreme left and filling the line.
7. Sign your name exactly as on the signature card on file at the bank.
8. Use cheques printed on safety paper.
9. Destroy all cheques on which you make an error. Never erase any words or figures.
10. Notify the bank if one of your cheques is lost or stolen.
11. Never sign a blank cheque.
12. Never cash a cheque for a stranger.

Enrichment Material.

1. Give a reason for each of the rules given above.
2. Secure a cancelled cheque from someone and see if it was drawn according to the rules given above.
3. Secure a cheque printed on safety paper. Show

why it is difficult to alter a cheque printed on safety paper.

Savings Account.

Encourage the pupils to visit a local bank and to open a savings account. Interest on savings accounts is paid on all sums of \$1 and upwards. This interest is paid twice a year, or when the account is closed, on the minimum monthly balances. The bank reserves the right to require seven days' notice of the intention to withdraw any portion or all of the money deposited, but this notice is seldom enforced.

Current Account.

Any money deposited in a current account is always payable *on demand*. The bank takes care of the money, provides the owner the easier way of making his payments by cheque, and secures through the endorsed cheque a receipt for all sums paid. No interest is paid, and on small accounts a small monthly charge is made for service.

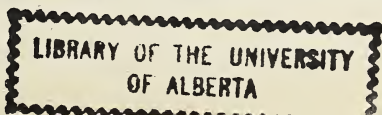
Page 64.

Certified Cheque: Exercise 12.

A certified cheque is one on which payment is guaranteed by the bank on which it is drawn. It is presented by the drawer to the bank for *acceptance*. The amount is charged to the drawer's account, and the bank's guarantee is then stamped across the face of the cheque.

Exercise 13.

Each bank seeks by the activity of its own business to keep its own bank notes in circulation, and therefore it



sends back daily to the bank of issue for redemption the bank notes of all other banks. Each bank is obliged to arrange for the redemption of its own notes in certain named commercial centers throughout the Dominion.

After I have presented my pay cheque, drawn on the Imperial Bank, to the Bank of Montreal and have received the money, the Bank of Montreal will send that cheque, along with many others, to the clearing house. At an appointed time, each bank sends one clerk and one messenger to the clearing house, and each messenger hands over the packages to the clerks representing the different banks. These clerks make out slips for the amount of the clearances, incoming and outgoing, and the totals are entered by the clearing house manager. Each clerk receives a slip of debits or credits. The bank settles or receives settlement from the clearing house manager daily. In smaller centers the cheques are distributed from bank to bank by messengers.

Enrichment Material.

Dramatize a scene at the clearing house. Have one pupil act as the clearing house manager, while others act as messengers and clerks. Use play currency and draw specimen cheques. Mark all cheques "sample," or void.

Page 65.

Exercise 8.

An average budget for a family of four persons with a total income of \$100 per month is as follows: savings, \$1 to \$2; shelter, \$28 to \$35; food, \$40 to \$45; clothes, \$15 to \$20; operations, \$8 to \$10; advancement, \$5 to \$7.

Enrichment Material.

Food is one of the most important items of household expenses. A recognized authority on nutrition divides each food dollar into fifths:

One fifth for milk, cream, and cheese.

One fifth for bread and cereals.

One fifth for fruit and vegetables.

One fifth for meat, fish, and eggs.

One fifth for fats, sugars, and miscellaneous foods.

Discuss the marketing for the above items under the following headings:

1. Seasonal foods and prices.
2. Nutritive values in relation to price.
3. Grading canned goods under "Fancy," "Choice," "Standard Quality," "Second Quality," and the uses for each grade.
4. Compare the contents of No. 2, No. 2½, and No. 3 size cans; compare the prices and note the saving you may make by purchasing larger sizes. Note, however, that for a small family it may be more economical to buy small cans.
5. Compare the cost of lump and granulated sugar, brown, and pulverized sugar. Honey, corn-syrup, molasses, and maple sugar should also be compared as to uses and price.

Page 66.

One of the best ways to form good habits of spending is to keep an accurate cash account of what you receive and what you spend. Bills are necessary if you are going to keep a record of your spendings. There is much confusion as to the form a bill should take and as to the

difference between a bill and an account. The textbook defines a bill as an itemized list of goods sold, or services rendered. On pages 66-72, you are shown sufficient bills to realize that the form of a bill must fit the particular business for which it is devised. Nevertheless there are several essential parts in every bill. These should be emphasized.

A bill is the record of a single business transaction. An account is a record of business covering a space of time, such as a week or month, and it includes payments made (credits) as well as amounts due (debits). If an account is addressed to Mr. Smith, the merchant debits his account in the firm's ledger with goods purchased and credits his account with payments made.

Make a study of various bill forms used in your locality and summarize the features that are common; also note any distinctive features of a particular bill form. Make the study as extensive as possible.

Page 67.

Receipts are very important and should be filed as soon as they are received. It is essential that the receipt indicates the service for which payment is made. Have the pupils list various forms of receipts: cancelled cheques, receipted bills, receipt forms, stubs of money order or postal notes, cash register slips, etc.

Pages 68 and 69.

Gas, used as fuel, is either natural or artificial. Alberta has three large fields of natural gas, one at Wainwright (Viking), one at Turner Valley, and a third at Foremost. Medicine Hat has its own private field. The cost of

natural gas to the consumer is much more reasonable than that of artificial gas. The Edmonton rates are listed in the textbook. Calgary has a slightly lower rate than Edmonton. In Calgary a 6-room house can be heated in average winter weather, including fuel for cooking and a hot water tank, for about \$15 per month.

Artificial gas is made from the destructive distillation of coal, particularly soft coal. A pound of good bituminous coal will yield about five cubic feet of coal gas. Vancouver and Winnipeg are supplied from this source. The following are the rates for Winnipeg:

First	400 cu. ft.	\$.75
Next	4600 cu. ft.	\$1.30 per 1000 cu. ft.
Next	20,000 cu. ft.	\$1.25 per 1000 cu. ft.
Next	25,000 cu. ft.	\$1.20 per 1000 cu. ft.
Next	50,000 cu. ft.	\$1.15 per 1000 cu. ft.
Next	200,000 cu. ft.	\$1.10 per 1000 cu. ft.
Over this amount		\$.95 per 1000 cu. ft.

There is a discount of 10¢ per 1000 cu. ft. except on the first 400 cu. ft.

The following are the rates for Vancouver:

First	100 cu. ft.	\$.50 per 100 cu. ft.
Next	900 cu. ft.	\$.12½ per 100 cu. ft.
Next	19,000 cu. ft.	\$.12 per 100 cu. ft.
Over this amount		\$.11½ per 100 cu. ft.

Enrichment Material.

1. Ask the pupils to explain the following data, and to interpret them as an item in cooking and heating: the heating power of Calgary natural gas is 1050 B. T. U., of Winnipeg artificial gas is 500 B. T. U., and of Vancouver artificial gas is 465 B. T. U.

NOTE.—The fuel value of coal is measured by the British Thermal Unit, commonly called B. T. U. It is the amount of heat necessary to raise the temperature of a pound of water 1° F. Calgary gas gives 1050 B. T. U. of heat for each 1000 cu. ft. of gas burned.

2. Where it is possible, experience should be gained in making actual readings of the gas meters at home. Bring the data to school.

Page 71.

Discuss different sources of motive power for turning the generators in the generating of electric power.

If possible have the pupils read electricity consumption from the meters at home and bring the readings to school for interpretation.

Page 73.

Supplementary Material: Practical arithmetic problems dealing with measuring and buying electricity.

The unit of measure in measuring electricity is the "watt hour." 1000 watts make 1 kilowatt. The cost of electricity is computed on the kilowatt hour, usually referred to as the kilowatt, kw.h., or K.W.H. The electricity used is measured by an electric meter which indicates the number of kilowatts used.

Section A.

1. The cost of electricity in Calgary is 5¢ per kilowatt hour. If your consumption for the month of April was 59 kilowatt hours, what would be the amount of your bill?
Ans. \$2.95.

2. The March reading on John Smith's meter was 2115 K.W.H.; the April reading was 2200 K.W.H.

What was the cost of electricity used at 5¢ per kilowatt hour?
Ans. \$4.25.

Section B.

The Electric Dept. of Calgary allows a discount of 15% if the bill is paid within a certain date.

3. Mrs. Robinson's bill for November showed a consumption of 62 K.W.H. at 5¢ per kilowatt. If she secured the discount, how much would she have to pay?

Ans. \$2.64.

4. Find the required payment on the following bill at 5¢ per K.W.H.

April reading..... 2846 K.W.H.

May reading..... 2918 K.W.H.

Discount of 15% allowed if paid before June 2nd.

The bill is paid May 29th. *Ans.* \$3.06.

5. A 40-watt electric light consumes 40 watts of electricity per hour. If the Anderson family use six 40-watt lights, how many kilowatts per hour do they use while all the lights are burning?

Ans. .24 K.W.H.

6. If the Jones family uses six 40-watt lights and two 25-watt lights on an average of 4 hours each evening during April, what is the consumption for the month?

Ans. 34.8 K.W.H.

7. At 5¢ per K.W.H. find the cost of electricity for the Smith household for May, if they use five 40-watt lights and three 25-watt lights on an average of 3 hours per night.

Ans. \$1.28.

Section B.

8. Mrs. James bought an electric washing machine which uses 300 watts per hour. If she uses it 5 hours

per day, 4 days a month, what will be the addition to her electric bill? *Ans.* 6 K.W.H.

9. The Elite Hotel uses 6 vacuum cleaners, each consuming 125 watts per hour. If they are in use 5 hours per day during the month of March, how much electricity is used for this purpose? *Ans.* 116.25 K.W.H.

10. A radio uses 100 watts per hour. How much per hour will it cost to run one at 7¢ per K.W.H.? *Ans.* .007¢.

11. The Smith Beauty Parlor operates 4 electric fans, each using 150 watts per hour, and 8 curling irons, each using 75 watts per hour. The appliances are in use 6 hours per day, 5 days per week. At 7¢ per K.W.H., what is the amount of the weekly bill? *Ans.* \$2.52.

Section C.

If you have electric appliances in your home exceeding 1500 watts, the city of Calgary will give you a combination rate as follows: For the first 40 K.W.H., 5¢ per K.W.H.; all over 40 K.W.H., $1\frac{3}{4}$ ¢ per K.W.H.

12. During the month of January, Mrs. Riley uses six 40-watt lights 6 hours per day, and an electric range (3800 watts) 4 hours per day. What is her bill at the combination rate? *Ans.* \$10.33.

13. During the month of December, Mrs. Evans used her washing machine (300 watts) 16 hours, electric ironer (1000 watts) 8 hours, and a water heater (660 watts) 16 hours. Her electric range (3000 watts) was used daily for 3 hours. What was the amount of her bill? *Ans.* \$6.59.

Section D.

14. Archie Greene uses a 4 H.P. electric motor in his shop, using 746 watts per hour for each horse power.

If he runs the motor for 8 hours a day and burns two 60-watt lights for the same time, what is his daily cost for electricity at 5¢ per K.W.H.? *Ans.* \$1.25.

15. At his refreshment stand at the Fair, Joe Archer used a hot plate (1000 watts) 12 hours a day, and two 100-watt lights 5 hours a day. At 6½¢ per K.W.H., find his electric bill for the six days of the Fair. *Ans.* \$5.07.

16. Miss Andrews runs a dressmaking shop in which she uses an electric sewing machine (400 watts) 4 hours per day, an electric iron (600 watts) 2 hours per day. Her electric window sign uses four 40-watt lights 4 hours per day. What is her daily expense for electricity at 4½¢ per K.W.H.? *Ans.* 15¢.

17. The Economy Service Station secured the agency for the Just-Rite radio. The attendant kept a demonstration model working 9 hours a day using 100 watts per hour. The station being open every day during March, find the additional cost on the electric bill at 6¢ per K.W.H. *Ans.* \$1.67.

Page 74.

In some sections of the city of Calgary the amount and cost of water used are determined by water meters. In other sections a flat rate is charged, determined by the number of rooms and facilities as shown below.

The meter schedule is as follows:

First 5000 gallons.....	40¢	per 1000 gal.
Next 5000 gallons.....	36¢	per 1000 gal.
Next 20,000 gallons.....	33¢	per 1000 gal.
Next 30,000 gallons.....	26¢	per 1000 gal.
Next 90,000 gallons.....	18¢	per 1000 gal.
Next 350,000 gallons.....	16¢	per 1000 gal.

Next 500,000 gallons.....	14¢	per 1000 gal.
All over 1,000,000 gallons.....	13½¢	per 1000 gal.

Special garden rate, May to September (inclusive) only:

First 5000 gallons.....	40¢	per 1000 gal.
Next 5000 gallons.....	18¢	per 1000 gal.
All over 10,000 gallons.....	16¢	per 1000 gal.

Minimum charge on meters:

½-inch service per month.....	\$2.00
¾-inch service per month.....	2.20
1-inch service per month.....	2.60
1½-inch service per month.....	5.00
2-inch service per month.....	7.00

Domestic Rating (Flat Rate):

No. of Rooms:

3.....	\$14.00
4.....	15.00
5.....	16.00
6.....	17.00
Each additional room.....	75¢

5% discount allowed on all meter and flat rates, if paid within ten days of date of account.

Rate per Annum

Basin, each.....	\$1.50
Toilet, each.....	3.00
Baths, each.....	3.25
Sinks, each.....	1.50
Taps or additional fixtures...	.75
Lawns or gardens.....	.40 per 1000 sq. ft.
Horses, each.....	3.00
Automobiles, each.....	1.50
Cows, each.....	3.00
Laundry Tubs, per set.....	1.50
Water Motors.....	9.00

Problems should be constructed from this and similar data.

Project 3:

Measuring hay in the stack.

In the early days in the Prairie Provinces, the Mounted Police often found it necessary to buy hay in the stack. The following rule was an attempt to find the cubic contents:

$$\left(\frac{O + W}{4}\right)^2 \times L. \quad \text{The measurements were made in}$$

feet, and the answer was in cubic feet. O = *overthrow*, and is obtained by throwing a rope over the stack from ground to ground in several places and then finding the average in feet. W = *width* of the stack. L = *length* of the stack. (This rule does not work for round stacks).

To find the number of tons of hay in a stack, two things must be considered:

1. The type of hay (fine or coarse).
2. The length of time it has been in the stack.

For fine hay such as Prairie Wool, find the cubic contents by the above rule and divide by:

512 ($8 \times 8 \times 8$).....60 days in the stack.

422 ($7\frac{1}{2} \times 7\frac{1}{2} \times 7\frac{1}{2}$)...60 to 90 days in the stack.

343 ($7 \times 7 \times 7$).....longer than 90 days in the stack.

For coarse hay such as Timothy, Brome, and Rye Grass, find the cubic contents by the above rule and divide by:

589.....under 30 days in the stack.

581.....30 to 75 days in the stack.

514.....76 to 150 days in the stack.

(It is assumed that settling has stopped at 150 days.)

Example: A stack of Prairie Wool hay is 45 days in the stack. The dimensions are: average overthrow,

28'; width, 12'; length, 100'. Find the number of tons of hay it contains.

Solution: Cubic contents: $\left(\frac{12 + 28}{4}\right)^2 \times 100 = 10,000$ cu. ft.

Number of tons: $\frac{10,000}{512} = 19\frac{1}{2}$, (approx.)

Problem Scale.

The following scale is constructed from a number of thought problems standardized in Alberta as to difficulty by Dr. Sansom and reproduced with his permission. The difficulties are approximate. 10% difficulty means that 90% of the pupils should be able to solve this problem.

1. How long will 6 gallons of oil last in a lamp that burns 3 pints in a week?

Difficulty 10%

Ans. 16 weeks.

2. If a train travels a quarter of a mile in a minute, what is its rate per hour?

Difficulty 20%

Ans. 15 miles.

3. If there are 112 peaches of a certain size in a bushel, how many quart jars can be filled from 4 bushels, if 16 half peaches are put into each quart jar?

Difficulty 30%

Ans. 56 jars.

4. A certain cow weighs 73 stones. (A stone is an English measure of weight). Last year she gave 1533 gallons of milk. If a stone is 14 pounds and a gallon of milk weighs 10 pounds, how many times her own weight of milk did she give during the year?

Difficulty 40%

Ans. 15 times.

5. How many feet of wire are needed to put a fence

all around a field 60 yards long and 48 yards wide, using 4 strands of wire?

Difficulty 50%

Ans. 2,592 ft.

6. A square plot of ground is fenced, and there are just 9 posts on each of the four sides. How many posts are there in all?

Difficulty 60%

Ans. 32 posts.

7. How long does it take the small hand of a clock to move around 21 minute-spaces on the face of the clock?

Difficulty 70%

Ans. 4 hours and 12 min.

8. How much cheaper per year is an article costing \$10.00 which has to be replaced every 15 months, than an article costing \$6.00 which has to be replaced every 8 months?

Difficulty 80%

Ans. \$1.00

9. A carpenter offers to build a house for \$2800.00 if he uses lumber costing \$18.00 per thousand feet; but if the lumber is worth \$20.00 per thousand, he will ask \$2960.00. If the cheaper grade is chosen, find how much the lumber for the house will cost.

Difficulty 90%

Ans. \$1440.00.

10. A owes B \$505.00; B owes C \$495.00; and C owes A \$490.00. Show how all the accounts can be settled by two small payments together amounting to \$15.00.

Difficulty 99%

Ans. A pays B \$10; A pays C \$5.

Explanation: A pays \$15.00 more than he receives.

B gets \$10.00 more than he pays.

C gets \$5.00 more than he pays.

SECTION III

It is very important that a thorough explanation and interpretation of the language of percentage be given to the pupils. Experimental evidence indicates a confusion of whole numbers, decimals, and common fractions with the elements of percentage. Percentage should be an exercise in clear thinking.

In the beginning it would seem well advised to continue the work of Grade VI, using squared paper and shading certain sections of a block of 100 small squares as representing per cents (fractional parts) of the whole. Later this should be advanced to include the shading of 100 squares and a per cent (fractional part) of a second group of 100 squares. Make sure that the pupils understand the meaning of 100%, 200%, 300%. Emphasize the fact that the whole of anything is 100%; if you double it, you get 200%. Pupils get the idea that per cent means "out of the hundred" instead of "on the hundred."

The pupils should be encouraged to report any use of the term that they may encounter. Advertisements in local newspapers will be helpful in this connection. In their work with decimals, they learned to write hundredths; now they are learning to write hundredths in another way. There are three tools with which we can accomplish a given task: the fraction, the decimal, and the per cent. Sometimes it is easier to use one tool than either of the other two; for this reason, certain well-

known and often-used equivalents should be taught and drilled. (See page 79.)

Examples.

1. To find $137\frac{1}{2}\%$ of \$64, it is much easier to take $\frac{11}{8}$ of \$64 than $\frac{137\frac{1}{2}}{100}$ of \$64 or $1.37\frac{1}{2}$ of \$64.

NOTE.—Emphasize the fact that “of” means “ $\times$.”

2. To find 20% of \$14.73, it is easier to find .20 of \$14.73 than $\frac{20}{100}$ of \$14.73 or $\frac{1}{5}$ of \$14.73.

3. To find $33\frac{1}{3}\%$ of 72, it is easier to find $\frac{1}{3}$ of 72 (or to divide 72 by 3) than to multiply $.33\frac{1}{3} \times 72$.

NOTE.—Whenever in doubt, for simple percentages, use the decimal equivalent.

Pages 77 to 79.

Many additional exercises in changing from per cents to decimals and to fractions should be given, especially if it is found necessary after doing the work of page 79. Diagnose the difficulties and apply specific teaching. Keep your problems so simple that the entire attention can be focused on the principles of percentage. Do not obscure the idea of percentage by having pupils reduce fractions to lowest terms as: $36\% = \frac{36}{100}$, not $\frac{4}{25}$.

Page 81.

The features common to all quantitative thinking should be emphasized. Percentage is merely another way of applying fractions and decimals, and since you can add and subtract fractions and decimals, so you can add and subtract per cents.

Page 82.

The teacher should read page 96 in the textbook to see the plan of instruction the authors have in mind. Each of the three cases of percentage is taught separately, and then all the cases are brought together in such a way that the pupils are compelled to analyze problems and to decide what formal work is involved.

Page 82.*Supplementary Material.*

1. In the crop year 1934-35, of every 100 bushels of wheat that went on the world market, Canada shipped 35; Australia, 20; Argentina, 20; United States, 10; Russia, 8; the Balkan countries, 7.

Interpret this data in terms of per cents.

2. A 1 per cent grade is one that rises one foot in every 100 feet of distance.

(a) Explain the meaning of the following: 2 per cent grade, 5 per cent grade, 10 per cent grade.

3. When a horse can pull 1000 pounds on a level road, he can draw only 900 pounds up a 1 per cent grade, 800 pounds up a 2 per cent grade, 400 pounds up a 5 per cent grade, and 250 pounds up a 10 per cent grade.

Calculate the effect on a team of horses drawing a ton load up various grades.

4. Employment in Canada.

If we analyze the Dominion census figures of 1931, we find that out of every 100 "gainfully employed" Canadians, the distribution is approximately:

29 are farmers.

16 are engaged in the "services" and professions.

16 are engaged in manufacturing.

- 10 are retail and wholesale people.
- 8 are in transportation and communication.
- 6.5 are from the building and construction trades.
- 3 are employees of governments or public administration.
- 2.5 are engaged in forestry, fishing, or trapping.
- 2 are in finance.
- 2 are in mining.
- 5 are unclassified.

(The figures are compiled by K. R. Wilson in Macleans Magazine).

The population of Canada in 1931 was 10,376,786. Take the population of those "gainfully employed" as 10,000,000, and find approximately the number in each classification.

Pages 88 and 89.

Before beginning this page, refer to page 28.

Supplementary Material.

1. On Sept. 9, 1935, the standing of the baseball teams in the National League was as follows:

	W.	L.	Pct.
St. Louis.....	84	48	.636
Chicago.....	83	52	....
New York.....	79	50	....
Pittsburgh.....	77	59	....
Brooklyn.....	60	71	....
Cincinnati.....	58	78	....
Philadelphia.....	55	76	....
Boston.....	33	95	....

Complete the standing in points as three-place decimals.

2. What is the ratio of the length of the textbook to its width?

3. What is the ratio of the number of boys in your class to the number of girls?

4. What is the ratio of the height of the door in your classroom to its width?

5. What is the ratio of 1 peck to 1 bushel? to 1 quart?

Project 4:

The School Lunch.

A part of the lunch, consisting of such foods as sandwiches, plain cake, or cookies, fruit, custard, or simple puddings, may be brought from home. A hot dish should be prepared by the girls each day.

The following recipes will serve twenty-five persons. Reduce or increase the amounts to give the required recipe for your class:

Cocoa

$\frac{3}{4}$ cup cocoa, 1 cup sugar, 4 qt. milk, $\frac{1}{2}$ qt. boiling water, $\frac{1}{2}$ pt. cold water.

Cream Soup—Potato

4 lb. potatoes, 2 medium onions, 1 qt. boiling water, parsley, 5 qt. scalded milk, 1 cup fat, $\frac{3}{4}$ cup flour, 3 tablespoons salt, pinch of cayenne.

Creamed Eggs (Eggs with White Sauce)

$1\frac{1}{2}$ doz. hard-cooked eggs, $1\frac{1}{2}$ qt. white sauce.

White Sauce: $\frac{1}{3}$ cup fat, $\frac{1}{2}$ cup flour, $1\frac{1}{2}$ qt. whole milk, $\frac{1}{2}$ tablespoon salt, pepper.

Macaroni With Cheese

1 qt. macaroni broken in pieces, $\frac{3}{4}$ cup butter, $\frac{3}{4}$ cup flour, 2 tablespoons salt, $\frac{1}{4}$ tablespoon paprika, 2 qt. milk, 3 cups chopped cheese.

Ask your mothers how to prepare the above recipes. Provide other suitable recipes for the noon lunch and

enter them in your personal arithmetic book. Attempt to provide suitable proportions to supply your school.

Pages 90 and 91.

In comparing numbers and stating the ratio of the one to the other, the most common error is to write the ratio fraction upside down.

Supplementary Material.

1. A $5\frac{1}{2}$ -pound chicken weighed $3\frac{3}{4}$ pounds when dressed. What was the per cent of waste? *Ans.* $31\frac{9}{11}\%$
2. A meter equals 39.37 inches. What fraction of a meter is a yard? *Ans.* $\frac{3600}{3937}$.
3. Jack weighs 121 pounds. Normal weight for his age and height is 132 pounds. What per cent is he underweight? *Ans.* $8\frac{1}{3}\%$
4. A \$25 suit of clothes was sold for \$22.50. What was the per cent of reduction? *Ans.* 10%
5. Mary's sister had her wages increased from \$3.60 a day to \$3.96 a day. What was the per cent of increase? *Ans.* 10%

NOTE.—A wealth of material can be obtained from advertisements in newspapers. See the textbook, page 25, for illustration.

Page 92.

Refer to the introductory material in Section II of this Manual. Outline as many ways as you can in which thrifty buying takes place, as: buying at sales, buying things out of season, buying in bulk or quantity, buying for cash, personal shopping.

NOTE.—It is not being thrifty to buy an inferior

article, nor is it thrifty to buy something the use of which is not commensurate with its cost.

For various reasons, merchants often have "special sales" in which a reduction, or a discount from the regular price is given. Ask the pupils to list as many reasons as they can why merchants discount goods or put on "special sales."

Page 93.

This case is the least practical of the three cases in percentage. From a study of the problems on page 93, you will note that in a life situation the answer would already be known. This case should receive brief treatment.

Supplementary Material.

1. A certain breakfast food loses 9% of its weight after standing a few weeks. How much will the manufacturer have to put in a box so that the contents will weigh 12 ounces after standing? *Ans.* $13\frac{17}{11}$ oz.

2. If a loaf of bread loses 15% by evaporation when in the oven, find the scaling weight of a 20-ounce loaf.

Ans. $23\frac{9}{17}$ oz.

3. If wheat seed has a germination test of 90%, find how many bushels of wheat a farmer should sow per acre to insure 100% germination, on a 2-bushel to the acre sowing.

Ans. $2\frac{2}{9}$ bu.

4. Find the weight of a bushel of oats that weighed 15% over the weight of a standard bushel.

Ans. 39.1 lb.

5. Water expands 10% on freezing. Find the volume of 1 cu. ft. of water after freezing.

Ans. $1\frac{1}{10}$ cu. ft.

Page 96.

Emphasize that these three kinds of problems in per cent correspond to the three kinds of problems in fractions:

1. To find any per cent (fractional part) of a number.
2. To compare two numbers and find what per cent (fractional part) the one is of the other.
3. To find a whole number when some per cent (fractional part) of it is known.

*Project 5:**Marketing Milk.*

Use the following facts as a basis, and develop a parallel case for your own district using the local prices:

1. 100 pounds of milk divides into about 40 quarts for retailing.
2. It is the established custom for the distributors to raise or lower the price 40¢ per cwt. to the producer, as the price rises or falls one cent per quart to the public.
3. Assume a nominal price to the producer of \$1.95 per 100 pounds of milk testing 3.6% butterfat.
4. The distributors deduct 5 cents per cwt. from the producers, for each decimal point below 3.6% butterfat.
5. Assume an average cost of delivery from producer to distributor of 25 cents per cwt. This charge is borne by the producer.
6. The city of Calgary regulations require milk supplied to the public to test $3.2\frac{1}{2}\%$ butterfat. This gives the distributor $3.6\% - 3.2\frac{1}{2}\% = .3\frac{1}{2}\%$ or $3\frac{1}{2}$ points at 5¢ per point per cwt.

(see No. 4) which equals $17\frac{1}{2}$ cents per cwt. profit.

7. Assume a retail price of 10¢ a quart or 6¢ a pint delivered to the customer.
8. 100 pounds of milk will convert to 40 qt. or 80 pt. At 10¢ a qt. this milk will retail at \$4.00; at 6¢ a pt. for \$4.80.
9. It is customary in the winter to raise the price of a quart of milk to 11¢ and a pint to 7¢. The price to the producer is raised 40¢ per cwt. (see No. 2) and is then assumed to be \$2.40 per cwt.
10. The distributor has a heavy overhead which includes, besides capital outlay, expenses for services, pasteurization, bottling, and delivery. Assume the overhead to be 35% of the sales price.

With the information you secure, construct problems applicable to your own district and submit them to the class for solution.

Page 98.

Diagnostic Tests in Per Cent.

The most common errors for each part of the tests, other than in the computation, are as follows:

Part 1.

In changing decimals to per cents: pupil

(a) Drops the decimal point and annexes the % symbol. $.2 = 2\%$ or $.125 = 125\%$.

(b) Copies number and annexes % symbol.
 $3 = 3\%$.

- (c) Changes decimal to equivalent fraction and annexes % symbol. $.5 = \frac{1}{2}\%$ or $.12\frac{1}{2} = \frac{1}{8}\%$.
- (d) Omits integers in mixed decimals and changes decimal to per cent. $1.33\frac{1}{2} = 33\frac{1}{2}\%$.

2. In changing per cents to decimals: pupil

- (a) Merely drops % symbol in answer without changing to hundredths. $16.5\% = 16.5$.
- (b) Moves the decimal point to the left incorrectly. $116\% = .116$.
- (c) Inserts unnecessary zeros. $16.5\% = 16.05$ or $= 16.005$.
- (d) Drops % symbol and annexes zeros. $16.5\% = 16.50$.

3. Changing common fractions to hundredths and per cents: pupil

- (a) Merely copies numerator and writes as a one-, two-, or three-place decimal. $\frac{9}{10} = .9$ or $\frac{7}{25} = .07$ or $\frac{7}{25} = .007$.
- (b) Copies entire fraction and writes as hundredths. $\frac{9}{10} = .00\frac{9}{10}$.
- (c) Multiplies numerator by denominator. $\frac{3}{4} = .12$ or $\frac{7}{25} = .175$ or $\frac{7}{25} = \frac{175}{1000}$.
- (d) Errs in changing fractions to hundredths. $\frac{9}{10} = 9.10$ or $\frac{9}{10} = 9 \times 100 = 900$.

Part 2.

In finding a per cent of a number: pupil

- (a) Adds % symbol to answer. 20% of $65 = 13\%$.
- (b) Divides the numbers. 6% of $80 = 80 \div 6 = 16\frac{2}{3}$.

- (c) Errs in changing per cents to fractions or decimals. $133\frac{1}{3}\%$ of 60 = $\frac{1}{3} \times 60 = 20$,
 37.5% of 720 = $\frac{7}{8} \times 720 = 630$.

Part 3.

In finding per cent one number is of another: pupil

- (a) Divides base by percentage. $8 = \dots\%$ of 32, $32 \div 8 = 4$, $8 = 4\%$ of 32.

- (b) Fails to express quotient as per cent. $3 = \dots\%$ of 10, $3 \div 10 = .3$, $3 = 3\%$ of 10.

- (c) Multiplies base and percentage. $8 = \dots\%$ of 32, $8 \times 32 = 256$, $8 = 256\%$ of 32.

- (d) Computes decimals incorrectly.

$$\begin{array}{llll}
 144 = \dots\% \text{ of } 48 & 144 \div 48 = 3 & 144 = 3\% \text{ of } 48 & \\
 8 = \dots\% \text{ of } 32 & 32 \div 8 = 4 & 4 \times 10 = 40 & 8 = 40\% \text{ of } 32 \\
 8 = \dots\% \text{ of } 32 & 32 \div 8 = 4 & 4 \times 100 = 400 & 8 = 400\% \text{ of } 32 \\
 8 = \dots\% \text{ of } 32 & 32 \div 8 = 4 & 8 = \frac{1}{4}\% \text{ of } 32 &
 \end{array}$$

Part 4.

In finding a number with a per cent given: pupil

- (a) Multiplies numbers representing rate and percentage.

$$7 = 20\% \text{ of } \dots \quad 7 \times 20 = 140$$

- (b) Divides the numbers disregarding decimal form.

$$\begin{array}{llll}
 7 = 20\% \text{ of } \dots & 20 \div 7 = & 2\frac{6}{7} & \\
 20 = 20\% \text{ of } \dots & 20 \div 20 = & 1 & 20 = 20\% \text{ of } 1
 \end{array}$$

- (c) Computes incorrectly in division of decimals.

$$7 = 20\% \text{ of } \dots \quad 7 \times 20 = 14.0, \text{ or } 1.40, \text{ or } .140$$

$$7 = 20\% \text{ of } \dots \quad 7 \div 100 = .07$$

You will find other errors, but the above are the most common ones. After you have recorded the mistakes, diagnose the errors, apply remedial teaching, and retest to learn how successful your remedial teaching has been.

Page 100.

In Cumulative Test I, the numbers in parentheses on the right refer to pages in the book where further practice on that particular difficulty may be found: for example, exercises 6, 9, and 14 refer to page 39: Finding Difficulties in Addition and Subtraction of Decimals.

Page 106.

On pages 103-105 you have been introduced in an informal manner to the terms and expressions associated with profit and loss and to their meanings. Note the distinction between gross profit or margin and net profit.

Marking by a code has been found to be a satisfactory method for developing profit and loss. Take your textbook and ask the pupils to name the various items that enter into its preparation, such as: manufacturing of the paper, printing, cuts, binding, royalty for the author, publisher's profit, costs of distribution. In Alberta the Government distributes these books, allowing 15% profit to the retailer. Take 15% from the price paid for a book and you have the retailer's cost price. In many businesses it is essential for stock taking, discounts, sales, and everyday trade transactions that the merchant have ready access to the cost price of each article. Keys are used. This key may be a word or a number of symbols.

C U M B E R L A N D**1 2 3 4 5 6 7 8 9 0**

A code word should conform to the following:

1. There should be nine or ten letters.
2. No letter should repeat.
3. The word should not be taken from a dictionary.

NOTE.—For ease in writing, merchants generally use lower case letters. The decimal is never inserted in the code, but it is assumed that there are two decimal places.

c u e represents \$1.25

c u e d represents \$12.50

1. Use the key and mark the cost price and the selling price on your textbook.

2. From the Cumberland key, give the cost price of articles marked as follows:

c u l e,

m r d,

c m d e

3. Find the per cent of margin on the articles sold as marked below:

$\frac{c m e}{\$2.50}$

$\frac{u e l d}{\$30.25}$

$\frac{c b r e}{c l e d}$

4. Determine the margin on the cost, and find the marked price:

c u e (margin 15%)

c d r e (margin $33\frac{1}{3}\%$)

c u l e (margin 110%)

m r d (margin 25%)

Within recent years, business men are more and more calculating profit or loss on the selling price of the article. The cash register and the merchant's charge accounts record selling prices only. The net cost of goods includes expenses which vary, making it difficult to find the actual net cost in many cases. Sales and delivery charges are difficult to estimate on a single article. From a study of his balance sheet for the previous year, a merchant can estimate how much margin he had to make on his annual turnover to clear all expenses and leave him a reasonable net profit. From this information he establishes his mark-up for the current year.

The following technique has been found helpful in enabling the pupil to distinguish the procedure to be followed when calculating profit or loss on the cost price and on the selling price.

On the cost price.

(1) Profit 10%
Cost 100%

(2) Loss 10%
Cost 100%

COST 100%	P. 10%
------------------	---------------

S. P. 90% OF C.	L. 10%
------------------------	---------------

$$\text{S. P.} = \text{C.} + \text{P.} = 110\% \text{ of C.}$$

$$\text{S. P.} = 90\% \text{ of C.}$$

On the selling price.

(1) Profit 10%
S. P. 100%

(2) Loss 10%
S. P. 100%

COST 90%	P. 10%
-----------------	---------------

S. P. 100%	L. 10%
-------------------	---------------

$$90\% \text{ of S. P.} = \text{C.}$$

$$\text{C} = \text{S. P.} + \text{L.} = 110\% \text{ of S. P.}$$

When we calculate profit on the cost price, the cost price is the whole and is represented as 100%. A profit of 10% must mean that the selling price is 110% of the cost price. When we calculate profit on the selling price, the selling price is the whole and is represented as 100%. The selling price must contain the cost *and* the profit. A profit of 10% means that 90% of the selling price equals the cost price.

To calculate profit on the selling price, a merchant must know his first cost (the cost of the goods put on his shelves). All expenses of doing business are included in the mark-up:

Example: A merchant marks his goods to make a profit of 20% on the selling price. What is the selling price of an article, the first cost of which is \$5.00?

Solution: First cost..... \$5.00

Mark-up is 20% of the selling price.

80% of the selling price = \$5.00

Selling price = $\frac{100}{80} \times \$5.00 = \$6.25$

Check: Margin \$6.25 — cost \$5.00 = \$1.25 profit

20% of \$6.25 = \$1.25

NOTE.—Much confusion will result unless all problems state the basis on which profit or loss is to be calculated.

Page 108.

Have the pupils gather as much data as possible about actual commission transactions that take place in their locality. Some are suggested on page 108. Other leads are, (1) on sales: auctioneers, insurance agents, implement agents, automobile salesmen, railway agents, practically all canvassing salesmen, radio, and refrigerator agents, brokers. (2) On purchase price: buying agents for grain, eggs, butter, hides, and other farm products; the buying of such orchard products as apples, pears, peaches, oranges; buying stocks and bonds.

NOTE.—Be careful not to give absurd problems about transactions where the sum of money sent an agent is to cover commission and cost of the purchase. Very seldom is commission paid in advance in this manner.

Page 112.

Supplementary Material.

Buying Commission.

1. A clerk wishes to buy a \$5,000 fidelity bond through the United States Fidelity Company. The cost is \$5 for a \$1,000 bond. He must also pay a 25% buying commission to the local agents of the company. What does the bond cost? *Ans.* \$31.25

A fidelity bond is a form of insurance against dishonesty; companies take out such bonds on employees in positions of trust. The bonding company agrees to reimburse a named individual, company, or organization in case of larceny on the part of the insured, in return for a stated annual premium.

2. An investment house charges a buying commission of \$2.50 per thousand bushels of grain (wheat, oats, barley, rye) and \$5.00 per thousand bushels of flax. What would be the buying commission on 10,000 bu. wheat, 8,000 bu. oats, 1,500 bu. rye, and 50,000 bu. flax? *Ans.* \$298.75

3. An investment house charges a commission of $\frac{1}{4}\%$ (per \$100 of par value) if the total par value of the shares purchased is less than \$5,000, and $\frac{1}{8}\%$ if \$5,000 or over.

(a) Find the commission on the purchase of 50 Dominion of Canada Bonds of par value \$100. *Ans.* \$6.25

(b) Find the commission on the purchase of 30 Province of Alberta Bonds of par value \$100. *Ans.* \$7.50

4. Milling companies employ buyers who are paid as commission $\frac{1}{2}\%$ of the value of the grain they buy. In two weeks, one buyer purchased 22,000 bu. of wheat at an average cost of 70¢ per bu. What was the amount of his commission? *Ans.* \$77

Pages 115 and 116.

Refer to page 92 and the supplementary work in the manual for preliminary work. Instead of printing an entire new catalogue whenever there is a price change, wholesalers send to their retail dealers a "discount sheet" giving the new discounts that are allowed from the list prices.

On the bill form on page 115, explain the meaning of the heading "Terms." Outline various terms offered by wholesale houses, e.g. 2/10, N/30.

*Project 6:**Transportation.*

The following are sailing distances to Liverpool from some Canadian and United States ports:

Churchill to Liverpool.....	2936 nautical miles
Nelson to Liverpool.....	2966 nautical miles
Montreal to Liverpool.....	2766 nautical miles
Quebec to Liverpool.....	2625 nautical miles
Halifax to Liverpool.....	2485 nautical miles
Saint John to Liverpool....	2717 nautical miles
Portland to Liverpool.....	2776 nautical miles
New York to Liverpool....	3036 nautical miles

Use a railroad time-table and calculate the distance from your nearest town to Liverpool via the various ports listed. (1.151 common miles = 1 nautical mile.)

Study the advantages and disadvantages of each of these routes for shipping (a) cattle, (b) wheat to Liverpool.

(From Le Pas to Churchill is approximately 510 miles.)

Compare the northern, eastern, and western rail outlets for prairie grain. Compare the rates. (These may be obtained from any railroad station.) Consider the

effect of elevation on these rates. (There is a favorable drop in elevation of 851 feet between Le Pas and Churchill, while there is an adverse elevation of 815 feet between Winnipeg and Fort William.)

NOTE.—The average freight rate for grain from Alberta to Fort William is 24¢ per 100 pounds, approximately 14½¢ per bushel; from Fort William to Montreal, 4½¢ per bushel; from Montreal to United Kingdom points, 5¢ to 6¼¢ per bushel. From Alberta to Vancouver the freight rate is approximately 11¢ per bushel. From Vancouver, via the Panama Canal, to the United Kingdom the rate is 9¼¢ per bushel.

Page 120.

Problem Scale II.

In problem solving, errors are due more often to a failure to interpret the problem than to a failure to perform the necessary computations. The scales are so constructed that the computation is relatively simple in order that the pupil may be tested adequately in his interpretations of the conditions of the problem.

Record the test score under the following standards:

	NUMBER CORRECT		NUMBER CORRECT
Excellent.....	9 or 10	Fair.....	5 or 6
Good.....	7 or 8	Unsatisfactory.....	0 to 4

The following curriculum tests are suitable after the child has finished Section III.

A. Fill in the blanks correctly:

1. Per cent means the hundred.
2. To change a decimal to a per cent move the decimal point places to the and add the per cent sign (%).

3. To change per cents to decimals, drop the per cent sign and move the decimal point places to the
4. 100% means of anything.
5. The selling price less the cost is called the
6. The cost of running a business is called the
7. The overhead subtracted from the margin gives the
8. Profit or loss may be calculated on the or on the
9. The commission paid to an agent who buys for another is called commission.
10. The list price less the discount is called the price.

Answers

1. on 2. two, right. 3. two, left. 4. the whole or all. 5. margin or gross profit. 6. overhead or operating expenses. 7. net profit. 8. cost, selling price. 9. buying. 10. net.

B. Problems to be solved.

1. At the school store Harry bought a textbook for which he paid 10% less than the regular price of \$1.40. How much did Harry pay for the book?
Ans. \$1.26
2. John sold his bicycle which he had used for two years for \$18. If the bicycle had cost him \$30, what per cent of the cost did he receive for it?
Ans. 60%

3. At a sale, Margaret paid \$12 for a hat. This was 80% of the regular price. What was the regular price?
Ans. \$15
4. Mr. Jones sold potatoes for 20% more than they cost. If they cost \$.80 a bushel, what was the selling price?
Ans. \$.96
5. A speed boat was sold for \$750. If the dealer's profit was 12% of the selling price, what was the total of the overhead and cost of the boat?
Ans. \$660
6. The first cost of an article was \$5.00. If the merchant made 20% of the selling price on the article, what was the selling price?
Ans. \$6.25
7. The cost price of an article was \$5.00. The merchant made 25% of the cost price on the article. What was the selling price?
Ans. \$6.25
8. A commission merchant sold 285 bushels of potatoes at 65¢ a bushel, and 350 barrels of apples at \$4.50 a barrel. He received $3\frac{1}{3}\%$ of the selling price for his services. How much did he remit to the farmer?
Ans. \$1,701.58
9. A contractor ordered 5 kegs of nails, 50 pounds to the keg. The cost was $4\frac{1}{2}\%$ a pound, less 10% for cash. Find the net cost for cash.
Ans. \$10.13
10. What is the rate of discount on a radio listed for \$75 and sold for \$60?
Ans. 20%

SECTION IV

Geometry is introduced through constructional or intuitive geometry. Activity, both physical and mental, is the keynote of this section. The interests of the pupil are kept in mind at all times; hence there is introduced the beginning of what we might term "Boy Scout" geometry.

The pupil must learn by actual construction and measurement the truths which he will later apply in his theoretical reasoning. The pupil is taken to actual life situations for his applications. He is introduced to some of the draftsman's instruments, and to simple formulas of the engineer or surveyor.

Pages 121 and 122.

These pages are introduced to give an intrinsic interest to the study of geometry. They show the pupil that construction and measurement have a definite use here and have their applications in the design of the beautiful pieces of architecture in the world.

Page 123.

From the beginning, pupils should be encouraged to apply the draftsman's techniques to their work. A sharp point in the pencil end of the compass is essential if accurate measurements are to be made. Trace lightly at first so that the lines are easily erased if necessary.

Neatness and accuracy are fundamentally basic in geometric construction and measurement. Measurements should be made with compasses or dividers, when possible, as outlined on page 124. An important feature to watch is the proper placing of the work on the page; proper spacing pleases the eye and leads to an economy in the amount of paper used.

Page 124.

Measuring with a ruler is likely to be inaccurate because the ruler has a degree of depth, and the scale is on the upper edge; consequently, the angle at which the eye views the point in the segment to be measured affects the accuracy of the measurement.



Lines are the first tools of geometry. Every figure, every diagram starts with a line. The word "straight" comes from an old word meaning "stretched." The fact that there are two sights on a gun barrel is evidence that two points can determine a straight line. When we limit such a line, as we do on this page, we speak of a "line segment," i.e. CE .

Supplementary Material.

1. Continue the work of Grade VI in which the length of various lines was estimated and then measured.

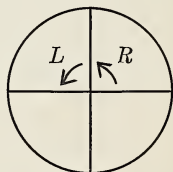
2. There are certain illusions that must be considered when estimating the lengths of lines:

- (a) Vertical distances are estimated as greater than equal horizontal distances. Draw two lines of the same length. Place one line in an horizontal

position and from its point of bisection, erect the other line at right angles. Have the pupils estimate the lengths of the lines, and then measure them.

- (b) Contrast makes a midget look even smaller when in the company of a tall man. Draw two lines, one $\frac{1}{2}$ " long and the other 4" long. Bisect each line and equally spaced on each side of the central point, draw two short perpendicular lines $\frac{1}{4}$ " apart. Ask the pupils to estimate the lengths of these middle sections; then measure. (Other measurements may be used.)

To illustrate the right angle, give each pupil a piece of paper in the form of a circle. Ask them to fold and crease twice. Open it out again and the creases will indicate a pattern similar to that shown. Start from the right angle. The left and right angles (*L* and *R*) are equal to each other; each is a right angle. Avoid the use of the term *degree* in your definition. The degree was made to be $\frac{1}{90}$ of a right angle and therefore was thought of after the right angle.



Page 125.

Children have numerous opportunities to visualize angles at home, in school, and on the school grounds. The most common angles are right angles; corners of streets (in general), books, tables, walls, pictures, boxes. The acute angle (acute means sharp) may be seen when a book or door is at first partly opened, when the lid of a trunk or pencil box is partly lifted, when the hinged

seat of the school desk is up. The above illustrations of the acute angle can be converted into obtuse angles (obtuse means blunt) with the exception of the seat. The straight angle may be illustrated by a wide-open book, by the fully opened hinged-lid of a box, and by the hands of a clock at 6 o'clock.

Use the clock face as a teaching device to illustrate various angles. Ask the pupils to stand and take the "arms-forward-stretch" position. Move the right arm through the acute to the right position. Next move the left arm through the obtuse to the straight angle position. Give drill to commands. Vary your drill to include semaphore signalling. Follow with seat exercises:

1. Sketch an acute angle, a right angle, an obtuse angle.
2. Sketch a wagon wheel, an automobile wheel, the flat surface of half an orange.
3. Sketch two streets meeting at an angle.
4. Sketch the hands of a clock as indicating certain specified times.
5. Sketch a "globe," indicating N. S. E. W.
6. Sketch a sun dial (simply an upright post on a plane surface) indicating the position of the shadow at specified times during the day.

Pages 128 and 129.

Have the pupils visualize the number of degrees in a circle, in a right angle, in half a right angle, in one third of a right angle, in one quarter of a right angle. Construct a circle of cardboard, similar to the face of a clock but divided into degrees. Affix to the center two hands of equal length. By varying the position of the hands any angle may be demonstrated.

The circumference of a circle is measured in the usual linear units, and also in a new unit of length, called an arc degree. An arc of 1° means $\frac{1}{360}$ of the circumference. In navigation an arc of one minute ($1'$) measured on a great circle of the earth is called a nautical mile.

Page 130.

The pupil must be made conscious of the fact that the work he is doing in measurement has its application in life. A visit to any machine shop or implement warehouse will reveal many practical uses for angular measurement.

Page 132.

Remember when measuring with a protractor, that the center of the protractor is the center of the circle from which the protractor was made. For convenience, only half of the circle is usually used.

Page 133.

Refer to page 88 in the textbook. Drawing to scale is a practical application of ratio ($1''$ to $1'$).

Supplementary Material.

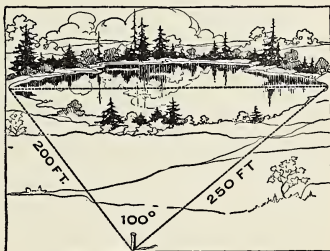
1. Take a map of Alberta, Manitoba, or Canada and note the scale used. Take any center, as Calgary, Edmonton, Brandon, or Winnipeg and, placing one point of the compass on that center, draw ever widening circles, according to the scale. For example, if the radius indicates 100 miles on the scale, every place on the circumference drawn, is 100 miles from the center. Using these lines as guides, calculate the relative air-line distance of points of interest from the center.

2. Make measurements of objects in and near the school, as: the door with its panels, the window with its panes, the classroom, the playgrounds and school, and make drawings to scale of these objects.

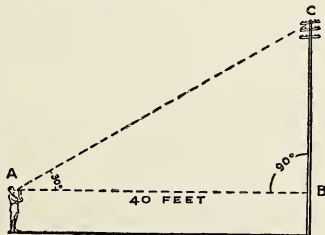
3. The more ambitious pupils might prepare a scale drawing of the school district, and locate roads and the homes of the children upon it.

Page 135.

The field protractor may be used to measure the distance between two points indirectly. Place the field protractor (transit, if you have one) at the post in the foreground. Measure the angle as shown by sighting along the pointers. With a tape, measure the two arms. Draw to scale and measure the side opposite the angle of 100 degrees. Convert this distance by using the scale.



The field protractor may be used to find the height of a pole. Sight along the horizontal position of the arm (this position may be obtained by dropping a plumb line from the 90° position through the center; the pointer will pass through the zero mark). Measure the angle BAC (30°), and measure the



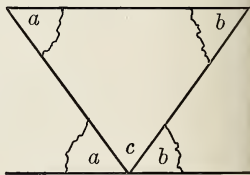
distance AB. Draw to scale; measure CB. Convert the measurement from the scale and add the height of the protractor (5 ft.); you have the height of the pole.

Page 136.

A compass consists of a magnetic needle, suspended to swing freely at the center of a card that is marked to show the principal directions. North, south, east, and west are called the cardinal points. The needle always points north.

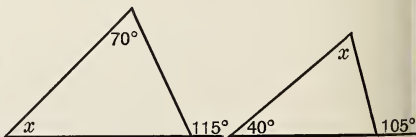
Pages 138 and 139.

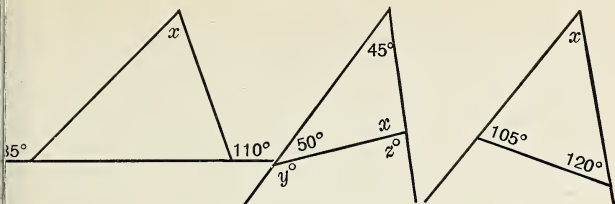
Remember: actual measurement must precede any use of the data given. Besides measuring the angles with a protractor and getting the sum equal to 2 right angles, other devices are used. One is to rotate a pencil through the three angles of a triangle and the point will be reversed in direction from its starting position. Another is to make a paper or cardboard model of a triangle, and remove two of the angles and fit them to the third angle as shown. A straight angle is formed.



Continue the sight exercises or puzzle figures on page 139 to include a knowledge of the straight angle.

Two more tools of the draftsman are introduced; two definite triangles made of wood or celluloid, a 30° - 60° right triangle and a 45° right triangle. These enable right



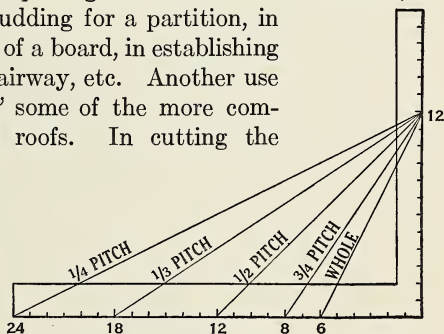


angles and parallel lines to be quickly and accurately constructed.

Page 140.

The carpenter's square is one of the most useful tools in the building trade. It is used wherever a right angle is required: in squaring door and window frames, in plumbing the studding for a partition, in squaring the end of a board, in establishing the steps in a stairway, etc. Another use is in "laying-off" some of the more common pitches for roofs. In cutting the

bevel on the rafters to fit against the ridge plate or the whole pitch, 12" on the 3" arm is placed at the upper corner



and the square is moved until 6" on the 24" arm is on the lower edge of the rafter. With a pencil, draw a line along the 18" arm on the outside. Reverse the procedure and cut the bevel on the lower end of the rafter.

Page 142.

The rectangle is the most common of all geometric forms.

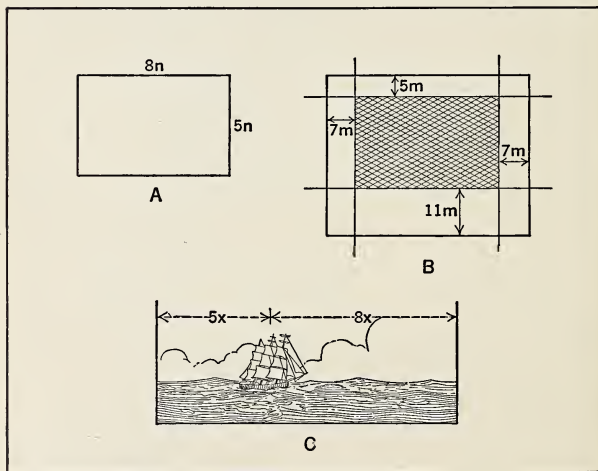
1. Pick out rectangular shapes in and around the school building; shapes of building lots, farms, floors, walls, ceilings, windows, doors, pictures, books, fences, sidewalks.

2. Substitute a right triangle and straight-edge (ruler) for the protractor and ruler and repeat exercises 3 and 4 on page 142 of the textbook.

3. (a) Make a piece of cardboard $8'' \times 5''$ and mount a picture, cut to a proper size, as directed.

(b) Take a picture and supply an appropriate mount for it. Mount the picture.

(c) Make a mat to go over a picture to be framed.



RATIOS IN ADVERTISING

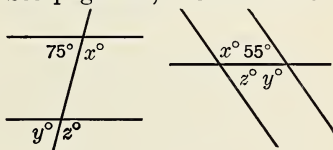
Fig. A. A rectangular form like a sheet of paper, cover of a book, a printed mass, a sketch, or photograph has the greatest appeal when the ratio of its width to its length is approximately 5:8. Fig. B. Rectangular masses within a rectangular frame should have margins in the following ratio: top, sides, bottom = 5 : 7 : 11. Fig. C. The important object of an illustration or photograph should be placed at a point whose distances from the sides have a ratio of 5 : 8. (Other ratios which may be used are 2 : 3, 3 : 5, and 8 : 13.)

Page 143.

For making angles equal to given angles, carpenters use a tool called a T-bevel. It is made of one rigid section and a sliding arm that can be clamped in any position. Borrow such a tool or make one from two strips of cardboard fastened at one end with a paper fastener, and practise making angles equal to given angles.

Page 144.

Learn to draw parallel lines using a straight edge and a 30° - 60° right triangle. See page 140, exercise II for method; also page 144, drawings 2 and 3 for illustration.

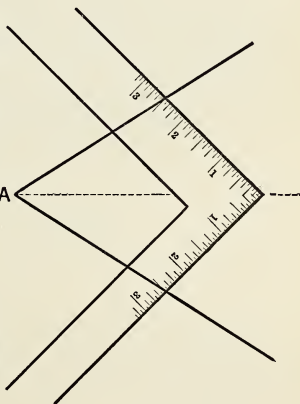
**Page 145.**

Practise drawing parallelograms, using the method for drawing parallel lines as described for page 144; also use a T-bevel.

Ask the pupils to draw puzzle figures, and then by measurement or reasoning to calculate the value (degrees) A of various angles.

Page 149.

The cut shows how a carpenter bisects an angle with his square. Try this method.



*Supplementary Material: Exercise 3.**Hours of Daylight (Sunlight).*

	Quebec		Toronto		Winnipeg	
	Rise	Set	Rise	Set	Rise	Set
January 1	7:30	16:07	7:52	16:51	8:20	16:36
January 15	7:27	16:24	7:49	17:06	8:23	16:54
January 31	7:11	16:47	7:37	17:27	8:05	17:20

- (a) From the table, calculate the number of hours of sunlight on January 1 in Quebec, Toronto, and Winnipeg.

$$\text{Ans. } \left\{ \begin{array}{ll} \text{Quebec} & 8 \text{ hr. } 37 \text{ min.} \\ \text{Toronto} & 8 \text{ hr. } 59 \text{ min.} \\ \text{Winnipeg} & 8 \text{ hr. } 16 \text{ min.} \end{array} \right.$$

- (b) Find the increase in the length of the day in each city from January 1 to January 31.

$$\text{Ans. } \left\{ \begin{array}{ll} \text{Quebec} & 59 \text{ min.} \\ \text{Toronto} & 51 \text{ min.} \\ \text{Winnipeg} & 59 \text{ min.} \end{array} \right.$$

	Quebec		Toronto		Winnipeg	
	Rise	Set	Rise	Set	Rise	Set
March 21	5:47	17:58	6:21	18:31	6:30	18:41
September 21	5:29	17:46	6:03	18:19	6:11	18:29

- (a) From the table, calculate which city comes the closest to having equal day and night (1) at the spring equinox (2) at the fall equinox.

$$\text{Ans. } \left\{ \begin{array}{ll} (1) \text{ Quebec} & 12 \text{ hr. } 11 \text{ min. day.} \\ & \text{Toronto } 12 \text{ hr. } 10 \text{ min. day.} \\ & \text{Winnipeg } 12 \text{ hr. } 11 \text{ min. day.} \\ (2) \text{ Quebec} & 12 \text{ hr. } 17 \text{ min. day.} \\ & \text{Toronto } 12 \text{ hr. } 16 \text{ min. day.} \\ & \text{Winnipeg } 12 \text{ hr. } 18 \text{ min. day.} \end{array} \right.$$

NOTE.—The times are tabulated as though the hours went to 24 o'clock. The figures after the point stand for the minutes as in railway time-tables.

Ask the pupils to watch the local newspapers for data similar to that on page 94.

Page 154.

The area of a rectangle has been expressed as the product of two adjacent sides. It is easier to remember this rule or relationship when expressed in a concise manner; hence the use of the formulas $A = s^2$ and $A = lw$. Thus the work in elementary mensuration leads to the establishing of formulas.

“Peri” means around, and “meter” means to measure; hence “perimeter” means to measure around.

Page 159.

A teacher must have names and meanings for the tools she uses. In Grade VI the pupils became familiar with the term “factor.” Develop square root as one of the two equal factors of a number, using the multiplication tables as a basis for your work. If desired, squared paper may be used and squares constructed. By counting the number of small squares on a side, a number that corresponds to the square root of the number of small squares in the entire square may be found.

Supplementary Material.

Use the formula $A = s^2$.

1. Give such exercises as the following:

$$1^2 = \dots; \quad 2^2 = \dots; \quad 3^2 = \dots; \quad 4^2 = \dots; \\ \text{to } 25^2 = \dots$$

2. Follow with such exercises as:

(a) When $s = 5$ in., 3 ft., 13 yd., 25 rd., find A .

(b) When $A = 25$ sq. in., 81 sq. rd., 196 sq. ft., find s .

Page 161.

Have the pupils do the practical work outlined experimentally. Care should be taken lest they confuse the slant height with the altitude.

Pages 162 and 163.

Again let the pupils discover experimentally the truth set down in the formula $A = \frac{1}{2} ba$.

Exercise 17 uses the term "similar" in a broad sense. It means to draw triangles shaped as nearly as possible like those given and does not refer to the strict equality of corresponding angles.

Page 164.

Stress the point that the ratio of two quantities of the same kind is the quotient of their numerical measures in terms of a common unit. That is, in any circle

$$\frac{\text{circumference}}{\text{diameter}} = 3.1416. \quad \pi \text{ is a letter of the Greek}$$

alphabet and corresponds to the English letter *p*. It is the first letter of the Greek word which means "circumference," and was originally used to represent the boundary of a circle. Since 1607 it has been used to represent the above mentioned ratio.

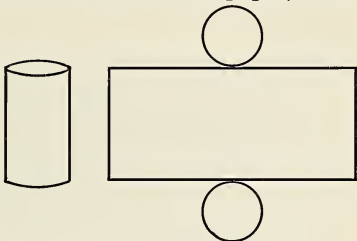
Page 166.

The base of each triangle is far from being a straight line. If the angle at the center were 2° or smaller, the base would approximate a straight line.

NOTE.—The surface area of a cylinder should be introduced in Grade VII. Give each pupil a cylindrical tin can and a large sheet of paper. Roll the paper around the cylinder, crease, remove, and cut along the creases.

You have a rectangle that just fits the curved surface of the can. Place each end of the can on the paper, trace around and cut from the paper. Place as shown.

Develop: area of curved surface = $2 \pi r \times h$, or $2 \pi r h$; area of each base (circular end) = πr^2 .



Exercises.

1. Find the total surface area of the can used in the above experiment.
2. Use exercises from other sources to enlarge on this topic.

Page 168.

In Alberta, refer to *Number Highways 6*, pages 102 to 110 for previous work done by the pupils.

There is considerable controversy as to how volume should be expressed:

$$V = 4 \times 8 \times 6 \times 1 \text{ cu. in.} = 192 \text{ cu. in.}$$

$$V = 4 \times 8 \times 6 \text{ cu. in.} = 192 \text{ cu. in.}$$

$$V = (4 \times 8 \times 6) \text{ cu. in.} = 192 \text{ cu. in.}$$

$$V = 4 \times 8 \times 6 = 192 \text{ cu. in.}$$

This last method, the one used in your textbook, is widely used. Do the multiplying, using unsigned numbers, and then sign the answer.

Page 169.

The *volume* of a cylinder should be taught in Grade VII. To find the volume of a cylinder, proceed as you do when finding the volume of a rectangular solid. Since the base of a cylinder is a circle, first find the area

of the base and multiply it by the height, or $V = \pi r^2 \times h$ or $\pi r^2 h$. Follow this explanation with practical problems.

Project 7:

Bushels of grain in a bin.

The general rule in measuring grain in a bin is to allow $1\frac{1}{4}$ cu. ft. to a bushel. Multiply the width in feet by the length in feet by the depth of the grain in feet and divide by $1\frac{1}{4}$. It is sometimes easier to remember that the number of bushels is $\frac{4}{5}$ of the cubic content of the grain measured in cubic feet.

Example:

How many bushels of wheat are there in a full bin 6 ft. wide, 8 ft. long, and 5 ft. deep?

Solution: $\frac{4}{5} \times 6 \times 8 \times 5 = 192$ bu.

Wheat is generally measured by weight. 60 lb. = 1 bu. Take a bushel measure filled with wheat and weigh. Subtract the weight of the empty measure and you have the weight of a bushel of your own wheat. To find the number of bushels of wheat in a bin by weight, multiply the number of bushels, cubic measure, by the actual weight of one bushel, and divide by 60. Use the above directions and assume that your bushel of wheat weighed 70 lb.

Number of bushels: $\frac{192 \times 70}{60} = 224$

Now do the work in one step:

$$\frac{4}{5} \times 6 \times 8 \times 5 \times 70 \times \frac{1}{60} = 224 \text{ bu.}$$

The same method is followed with other grains. Substitute the number of pounds (standard) to the bushel of each grain.

Measure your bins at home and calculate the capacity

in bushels in each, by volume and by weight. Check your results when the grain is hauled to the elevator and weighed.

Page 177.

Topics for Special Report. Exercise 8.

The following are the world's eight great tunnels:

The Alps, separating Italy from Switzerland and France are pierced by four tunnels:

1. The Simplon Tunnel, 12.40 miles long.
2. The St. Gothard Tunnel, 9.26 miles long.
3. The Loetchberg Tunnel, 9 miles long.
4. The Mont Cenis Tunnel, 7.98 miles long.

In America we have:

1. The Cascade Tunnel, piercing the Cascade Range and 7.79 miles long.
2. The Moffat Tunnel, piercing the Colorado Rockies and 6.11 miles long.
3. The Connaught Tunnel, in the Selkirk Range and 5.02 miles long.
4. The Hoosac Tunnel, piercing the Berkshires in Western Massachusetts and 4.7 miles long.

Exercise 9. See textbook, page 197, for the depths of lakes.

Greatest depths of oceans: Pacific, 32,089 feet; Atlantic, 31,366 feet; Indian, 22,968 feet; Arctic, 13,200 feet; Mediterranean, 12,276 feet.

Exercise 10. The following are the heights of well-known mountains or mountain peaks: Mt. Everest, 29,141 feet; Mt. McKinley, 20,300 feet; Mt. Logan, 19,612 feet; Mt. Blanc, 15,781 feet; Mt. Ranier, 14,408

feet. In Canada, Mt. Robson, the highest peak in the Canadian Rockies, is 12,972 feet high. Near Banff, Alberta, there are Mt. Assiniboine, 11,870 feet, Mt. Victoria, 11,365 feet, and Mt. Hector, 11,135 feet.

Among the famous structures we find: the Woolworth building in New York, 792 feet high, the Metropolitan Life building, 700 feet high, the Singer building, 612 feet high, and the Municipal building, 560 feet high. The Eiffel Tower in Paris is about 984 feet; Bank of Manhattan, New York, 838 feet; Pyramid of Cheops, Egypt, 461 feet; St. Peter's Cathedral, Rome, 435 feet.

NOTE.—It is of interest to note that the Dead Sea is 1292 feet below sea level.

Exercise 13. In Alberta, turn to *Number Highways 6*, page 82.

SECTION V

The use of formulas in connection with interest is another step towards the use of general numbers. Such use of the formula will lead to equations and their use.

Refer to pages 62 to 64 for introductory material for this section. Banks pay interest on money deposited in a savings account at the rate of 2% per annum, on the basis of the monthly minimum balances. This interest is paid twice a year, in November and again in March.

Supplementary Material.

Ask the pupils to learn as much as they can about the factors that determine interest rates, as:

1. The security offered.
2. Long or short term loans.
3. The amount of the loan.
4. Maximum and legal rates.

Get some pupil to report on the method of calculating interest on savings accounts in banks.

Get reports from the pupils on factors concerned with securing a loan and with the repayment of same.

1. Likely sources of loans.
2. Security required.
3. When the interest is paid.
4. When and how the loan is repaid.

Pages 182 and 183.

More time should be spent on finding the interest than on finding the principal, the rate, or the time. In a

situation occurring in actual life, in the majority of cases, the principal, rate, and time would be known before the question was constructed.

Pages 185 to 187.

In Calgary, on residential property, the Board Companies use the following procedure in establishing the rate on a house. A basic rate of 50¢ per \$100 is set on a frame house. If the house immediately adjoining is less than 20 ft. away, 10¢ is added. If the house second away is less than 20 ft. from the house adjoining the house to be insured, 5¢ is added. The rate then, supposing the above conditions are true, is 65¢ per \$100 or \$6.50 per \$1,000 for 1 year. Three years' insurance is allowed for two annual premiums therefore $2 \times \$6.50$ represents \$13.00 for three years. The Board reduces this by 25%, leaving a rate of \$9.75 per \$1,000 of insurance for three years. Deductions are made according to construction: stucco, brick, stone, brick veneer, etc.

Supplementary Material.

1. Secure cancelled fire insurance policies and ask the pupils to read carefully the clauses that constitute the contract.

2. Ask the pupils to find how the rate is established on farm property, on their homes, in the town or city.

3. Discuss the meaning of the terms Board Company and Non-Board Company; also Mutual Company.

Page 191.

Are you keeping records of the progress made on these problem tests? It is essential that you do so. A knowledge of his progress is excellent motivation for a pupil.

SECTION VI

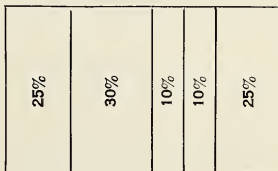
Graphs are used very frequently in newspapers, magazines, textbooks, and reference books. Graphs picture facts and figures so clearly that one can understand them at a glance. Different forms of the graph are depicted to illustrate the fact that one form may be more suitable for a particular kind of comparison or statistical data than another. The bar graph is generally used when very large numbers are compared by ratio (a graph is a picture of a ratio). In such cases the bar graph is not accurate but only approximate in its comparisons.

NOTE.—It is essential when dealing with children that all bar graphs should start from zero; otherwise the picture of the ratio is distorted for them and does not leave a correct impression on their minds.

The rectangle graph is used so often, associated with the bar graph, that it should be included in the work of this grade.

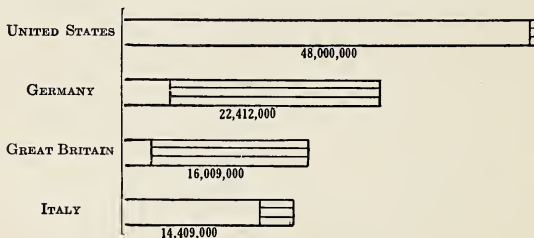
(a) How Ruth Williams spent a dollar:

Street car tickets....	25¢
School supplies.....	30¢
Ice cream.....	10¢
Shoe laces.....	10¢
Gift.....	25¢



(b) Unemployment Insurance.

	NO. OF WORKERS	INSURED
United States.....	48,000,000	250,000
Germany.....	22,412,000	18,200,000
Great Britain.....	16,009,000	12,094,000
Italy.....	14,409,000	2,600,000
United States.....		$\frac{1}{2}\%$ insured
Germany.....		81% insured
Great Britain.....		$75\frac{1}{2}\%$ insured
Italy.....		18% insured



There is an abundance of material in this section for the average pupil. The brighter minds should be encouraged to seek statistical material from many sources and to graph this material, choosing a suitable vehicle of expression.

SECTION VII

The Meaning of General Numbers.

The pupil has been introduced to formulas, to their construction, and, in a brief manner, to their manipulation. He now continues the use of letters for numbers, the meanings of letters in combination, and the expression of familiar processes in new forms. Early work must aim to accustom the pupil to the new notation. He must be trained to think in numbers when using letters. This work must be an exercise in clear thinking. The continued application of formulas emphasizes the practical utility of the subject. The formula leads to simple equations and their use.

Page 209.

As we can add integers, so we can add literal numbers. Refer to the work in the addition of compound numbers in Grade V as a preliminary step. The following points should be emphasized:

1. We do not memorize combinations with letters as we do with integers.
2. We can add like and unlike terms as: $s + s = 2s$,
 $P = a + b + c$. $a + b + c$ is the answer; nothing more is necessary.
3. When the coefficient is not expressed, it is always 1, as: $2a + a = 3a$, and not $2a$.

Page 210.

These problems are exercises in the making of formulas.

(a) *The Rule:*

To find the selling price of an article: (1) to the cost price add the gain; (2) from the cost price subtract the loss.

(b) *The formula:*

$$\begin{aligned} sp &= (c + p) \\ &= (c - l) \end{aligned}$$

A formula is a "shorthand" way of stating a rule. It is good practice to give exercises in stating formulas as rules. Carry this type of work through pages 211, 212, and 213. Emphasize the fact that parentheses show that the numbers enclosed are to be treated as one number.

Page 211.

As the pupil is familiar with the minus sign ($-$), it is not necessary in Grade VII to drill in negative or directed numbers. Refer to the subtraction of compound denominate numbers.

In teaching the subtraction of literal numbers with coefficients, a difficulty must be watched: $3s - 2s = s$, and not 1. As remedial work, substitute a concrete case as, 3 boys $-$ 2 boys $=$ 1 boy.

Page 212.

Exercise 1.

The pupil must get a complete concept of $A = lw$.

1. The area of a rectangle is equal to the product of its length and its width (same units in each case).

2. A , l , w , and lw are numbers.

3. A , a number, equals lw another number.

4. A , a number, equals l , a number, multiplied by w , another number.

It is essential that the pupils master each step. Those who have been taught that $3 \times 2 = 3 + 3$ are going to be confused when asked to take l , w times, unless the above points are mastered. When difficulties arise, substitute a concrete case.

The authors are practising sound pedagogy in keeping all work as simple as possible.

Enrichment Material.

On pages 210, 211, 212, and 213 give numerical values to the general numbers and then solve the questions, using the formulas constructed.

NOTE.—1. Is your answer reasonable?

2. Check to verify the accuracy of results.

Page 213.

Get the habit of writing division in fractional form when using general numbers (Example 2). The expression $\frac{x}{10}$ is commonly read “ x over 10.”

Page 215.

It is essential that the pupil understands that the formula gives an equation. Exercise 1: the formula $A = lw$ is true for all values of l and w . When A and l are replaced by the particular numbers 40 and 8, the w can have but *one* value, and $8w = 40$ is called an equation. The w is called the *unknown*. The value of w that “satisfies the equation,” that is, when substituted makes both sides have the same value, is called the *root* of the equation.

Pages 215 to 219.

The authors are following sound pedagogical procedure in the solution of equations when a full explanation of the work is substituted for the solution by axioms. The axioms will be given in Grade VIII.

When difficulties are encountered, make your work reasonable by showing an example in arithmetic.

Example: If $3x = 12$, what is the value of x ?

Answer: $x = \frac{1}{3}$ of 12, or 4. Use a diagram, if necessary, to depict $3x$ as 12 square inches.

Review of General Numbers. Tests of the following types may be presented at this time:

A. *State in words the meaning of the following formulas:*

- | | | |
|----------------------|--------------------------|-------------------|
| 1. $A = ab.$ | 2. $A = \frac{1}{2} ab.$ | 3. $C = 2 \pi r.$ |
| 4. $P = 4 s.$ | 5. $V = lwh.$ | 6. $i = prt.$ |
| 7. $P = 2l + 2w.$ | 8. $A = \pi r^2.$ | 9. $d = 2r.$ |
| 10. $V = \pi r^2 h.$ | | |

B. *Express each of the following statements as a formula:*

1. The cost of a number of books is the price of one book multiplied by the number of books purchased.
2. The rate of speed equals the distance travelled divided by the time.
3. Gain equals cost plus selling price.
4. Loss equals cost minus selling price.
5. The perimeter of a triangle equals the sum of the lengths of the three sides.

C. *Make equations for the statements below:*

1. Three times a number is equal to 12. *Ans.* $3n = 12$
2. If 7 is added to a certain number the sum is 12.
Ans. $n + 7 = 12$
3. I spend 10 cents and have 12 cents left.
Ans. $c - 10 = 12$
4. The difference between a number and 9 is 7.
Ans. $9 - n = 7$

5. Two times a number is the number plus 5.

$$\text{Ans. } 2n = n + 5$$

6. A certain number divided by 3 equals 12.

$$\text{Ans. } \frac{n}{3} = 12$$

7. Two boys earned \$12. One received twice as much as the other.

$$\text{Ans. } x + 2x = 12$$

8. Alice and her father together weigh 200 pounds. Alice weighs x pounds. Her father weighs three times as much as Alice.

$$\text{Ans. } x + 3x = 200$$

D. Solve the following problems using equations:

1. The formula for finding the distance when the rate of speed and the time are known is $d = rt$. Find d if $r = 6$ and $t = 8$.
2. The formula for the area of a triangle is $A = \frac{1}{2}ab$. Find A , if $a = 6$ and $b = 4$.
3. The perimeter of a rectangle is found with the formula, $P = 2l + 2w$. Find P , if $l = 6$ and $w = 8$.
4. The formula for finding the circumference of a circle is $C = \pi d$. Find C , if $d = 7$ inches.
5. The formula for the perimeter of a triangle is $P = a + b + c$, when a , b , and c represent the sides. Find P , if $a = 3$ in., $b = 1\frac{1}{2}$ in., $c = 3\frac{1}{2}$ in.
6. The formula for finding the net profit is: net profit = selling price minus total cost, or $p = s - c$. Find p , if $s = \$140.25$ and $c = \$120.15$.

E. Draw figures to represent each of the following equations and find the value of x :

1. $4x = 12$.
2. $x - 4 = 16$.
3. $x + 5 = 20$.
4. $\frac{x}{3} = 6$.
5. $2 + x = 9$.

*Project 8:**Personal Evaluation.*

Throughout the year your textbook and teacher have emphasized certain things. You have followed your own progress. At the end of the year a good business man takes an inventory of his business, so you are asked to attempt to give an honest opinion of your ability under the following headings:

- | | |
|-----------------------------------|-------------------------|
| 1. Neatness. | 2. Accuracy. |
| 3. Ambition. | 4. Obedience. |
| 5. Willingness to work. | 6. Health. |
| 7. Appearance. | 8. Politeness. |
| 9. Thrift. | 10. Habits. |
| 11. Courtesy. | 12. Manual ability |
| 13. Arithmetic. | (includes measurement). |
| 14. Ability to follow directions. | 15. English. |

Score: 4: Very Good.
 3: Good.
 2: Fair.
 1: Poor.

Put down what you think you are worth.
 Possible score is 60. What is *your* score?

Review of important points:

1. How are integers, mixed numbers, and decimals read?
2. What four questions about a problem are helpful in assisting you to solve problems?
3. Why are decimals replacing common fractions and mixed numbers in everyday measurement?
4. How can you be certain that the zero difficulty in the quotient has been mastered?
5. What short cuts taught in this textbook have you found helpful?
6. How should a cheque be written?
7. What is the meaning of per cent?

8. What is the meaning of ratio?
9. What is meant by a diagnostic test? a cumulative test? practice test? survey test? problem scale?
10. Review the vocabulary exercises.
11. Why do merchants sometimes calculate profit on the selling price of an article?
12. What is "overhead" in a business? "margin"?
13. Why do merchants issue bills and accounts?
14. Why is a receipt important? Why should it state the nature of the service rendered?
15. What is the value of making a budget?
16. In what way does interest differ from the three kinds of problems in per cent as outlined on page 96? What new element is added?
17. What do we mean when we speak of per cents greater than 100%?
18. What is an insurance policy?
19. Of what value is a problem scale in which the percentage of difficulty of each problem is given?
20. Name the tools of geometry about which you have studied, and state the use of each.
21. What is meant by "drawing to scale"?
22. In what way is a graph an illustration of ratio?
23. Why should all bar graphs start from zero in elementary work with graphs?
24. What is meant by the term *general numbers*?
25. In what way is an equation different from a formula?

NOTE.—It is now time for you, the teacher, to make a personal evaluation of your teaching for the year. As you make up your year's averages and establish ratings, consider the following:

1. At best you have sampled but a few experiences of life.
2. It is doubtful even if these experiences have been the best ones to choose; you have been guided by a carefully planned textbook.
3. It is more important that the pupil has worked up to capacity, than that he has excelled his classmates in progress. The really worthwhile rating is that of accomplishment in the light of ability.
4. Have you been vitally interested in the individual pupil?
5. Have you attempted really to interest the pupil in the subject? Will this interest persist after school days are over?
6. Have you, to the best of your ability, attempted to diagnose mistakes and to apply remedial teaching? Have you tested to see how successful your remedial work has been?
7. Have you attempted to replace the customary formalism of mechanical drill by exercises requiring clear thinking?
8. Is the pupil's outlook on life broadened by the work he has done in this subject? Is he better prepared to understand life situations, and to participate in them?
9. Have you a true appreciation of the aims and objectives of education as conceived by the authors, and applied in this textbook?

NOTE.—Prepare carefully a record of each pupil's shortcomings in this subject and pass it on to the next teacher, along with your record of promotion.

MATHEMATICS

for EVERYDAY USE

BOOK ONE

ANSWERS

THE JOHN C. WINSTON CO., LIMITED
TORONTO



BOOK ONE

SECTION I

Page 1.—1. Elementary; University. 2. Two times; eight times.

Page 2.—3. Four times. 4. \$520; \$18,200. 5. \$390. 6. \$2,990. 7. \$5,000. 8. \$18,500. 9. \$1,028. 10. \$86,000,000. 11. 776,000.

Page 4.—1. Addition: 1. 4,399. 2. 4,569. 3. 4,989. 4. 4,599. 5. 3,478. 6. 3,499.

Subtraction: 1. 311. 2. 2,128. 3. 2,236. 4. 3,805. 5. 2,326. 6. 624. 7. 958. 8. 99. 9. 9,979. 10. 6,009. 11. 1,858. 12. 998.

Multiplication: 1. 27,306. 2. 28,615. 3. 18,844. 4. 70,944. 5. 17,686. 6. 58,926. 7. 136,584. 8. 182,160. 9. 766,400. 10. 177,250. 11. 94,214. 12. 337,635.

Division: 1. 208. 2. 205. 3. $108\frac{2}{3}$. 4. 3,070. 5. $108\frac{1}{2}$. 6. 806. 7. 1,040. 8. 250.

Page 6.—**Set I:** 1. 15. 2. 16. 3. 16. 4. 20. 5. 18. 6. 17. 7. 14. 8. 18. 9. 16. 10. 21. 11. 17. 12. 18. 13. 13. 14. 19. 15. 15. 16. 20. 17. 17. 18. 21. 19. 16. 20. 24.

Set II: 1. 27. 2. 31. 3. 34. 4. 40. 5. 34. 6. 26. 7. 37. 8. 34. 9. 29. 10. 43.

Set III: 1. 461. 2. 498. 3. 491. 4. 417. 5. 367. 6. 432. 7. 329. 8. 608.

Set IV: 1. 25,468. 2. 12,616. 3. 88,651.

Page 7.—1. \$8.01. 2. \$4.74; \$1.42. 3. The set.

Page 8.—**Set I:** 1. *a*, 44; *b*, 407; *c*, 686; *d*, 25; *e*, 551. 2. *a*, 0; *b*, 20; *c*, 751; *d*, 30; *e*, 603. 3. *a*, 2; *b*, 4; *c*, 774; *d*, 360; *e*, 300. 4. *a*, 65; *b*, 445; *c*, 229; *d*, 271; *e*, 147. 5. *a*, 3,419; *b*, 329; *c*, 137; *d*, 581; *e*, 86.

Set II: 1. *a*, 1,128; *b*, 5,736; *c*, 498; *d*, 6,505; *e*, 526. 2. *a*, 1,301; *b*, 5,429; *c*, 2,996; *d*, 1,074; *e*, 408. 3. *a*, 9,969; *b*, 10,687; *c*, 5,008; *d*, \$.05; *e*, \$.07. 4. *a*, \$.30; *b*, \$1.20; *c*, \$83.36; *d*, \$.99; *e*, \$9.94.

Page 9.—1. No. 2. Yes—using round numbers. 3. 23,416,000 bbl.; 23,420,000; 23,400,000. 4. 1,925,000 bbl.; 1,920,000; 1,900,000. 5. 487,738,000 t.; 487,740,000; 487,700,000. 6. \$1,753,000; \$1,750,000; \$1,800,000. 7. 6,754,964,000 bu.; 6,754,960,000; 6,755,000,000. 8. \$1,876,000; \$1,880,000; \$1,900,000. 9. 3,045,000 lb.; 3,050,000; 3,000,000. 10. 8,001,000 gal.; 8,000,000; 8,000,000. 11. Alberta: 255,300; 255,000; 260,000. British Columbia: 355,900; 356,000; 360,000. Manitoba: 251,800; 252,000; 250,000. Northwest Ter.: 1,258,200; 1,258,000; 1,260,000. Ontario: 365,900; 366,000; 370,000. Quebec: 583,900; 584,000; 580,000.

Page 10.—**Set I:** 1. *a*, 56; *b*, 96; *c*, 80; *d*, 153; *e*, 3,648. 2. *a*, 860; *b*, 3,500; *c*, 1,803; *d*, 12,060; *e*, 3,549. 3. *a*, 27,540; *b*, 490; *c*, 3,096; *d*, 4,648; *e*, 5,202.

Set II: 1. *a*, 252; *b*, 9,072; *c*, 18,490; *d*, 30,600; *e*, 218,400.

2. a , 347,760; b , 276,138; c , 4,914; d , 4,050; e , 28,782. 3. a , 416,010; b , 564,364; c , 1,107,984; d , 5,001,680; e , 442,740.

Set III: 1. a , \$.08; b , \$.54; c , \$16; d , \$1,312; e , \$9. 2. a , \$.70; b , \$8,109; c , \$2,116; d , 18,089,500; e , 7,528,922. 3. a , 7,034,024; b , 27,835,830; c , 37,116,277; d , 20,776,000; e , 28,035,000.

Page 11.—1. 600 ft.; 300 ft. 2. 1,200 ft. 3. 1,100 ft. 4. 75,000 sq. ft. 5. 15,000 sq. ft. 6. 180,000 sq. ft. 7. $A = 100' \times 150'$; $B = 200' \times 150'$. 8. B is 15,000 sq. ft. larger. 9. \$.05. 10. 31,440 sq. ft. more.

Page 12.—Set I: 1. a , 3; b , 3; c , 2; d , 4; e , 3; f , 4. 2. a , 3; b , 2; c , 2; d , 2; e , 2; f , 2. 3. a , 3; b , 5; c , 2; d , 3; e , 6; f , 3. 4. a , 4; b , 7; c , 2; d , 4; e , 4; f , 7.

Set II: 1. a , 2; b , 9; c , 2; d , 4; e , 3; f , 7. 2. a , 9; b , 7; c , 9; d , 8; e , 3; f , 6. 3. a , 4; b , 8; c , 5; d , 6; e , 7; f , 7. 4. a , 4; b , 7; c , 5; d , 3; e , 9; f , 6.

Set III: 1. a , 21 and 20 rem.; b , 23; c , 11; d , 21; e , 21. 2. a , 34; b , 38; c , 88; d , 36 and 33 rem.; e , 86. 3. a , 21; b , 49; c , 14 and 84 rem.; d , 53; e , 44.

Page 13.—Set IV: 1. a , 30; b , 20 and 35 rem.; c , 90; d , 30 and 15 rem.; e , 20 and 8 rem. 2. a , 50; b , 40 and 4 rem.; c , 70 and 10 rem.; d , 30 and 10 rem.; e , 30 and 10 rem. 3. a , 70 and 20 rem.; b , 60 and 30 rem.; c , 74; d , 66; e , 43.

Set V: 1. a , 64; b , 80 and 25 rem.; c , 46 and 22 rem.; d , 60; e , 84 and 8 rem. 2. a , 82; b , 66 and 35 rem.; c , 48 and 13 rem.; d , 99 and 13 rem.; e , 79. 3. a , 47 and 5 rem.; b , 97 and 9 rem.; c , 93; d , 42; e , 95.

Set VI: 1. a , 211; b , 107; c , 293 and 41 rem.; d , 844 and 8 rem.; e , 282 and 25 rem. 2. a , 981; b , 155; c , 964; d , 387 and 20 rem.; e , 287 and 38 rem. 3. a , 748; b , 258; c , 709; d , 740; e , 820 and 47 rem.

Set VII: 1. a , 198; b , 54; c , 162 and 516 rem.; d , 288 and 184 rem. 2. a , 211 and \$.10 rem.; b , 80 and \$4.97 rem.; c , 122 and \$1.78 rem. 3. a , 62 and \$1.21 rem.; b , 103; c , 712.

Page 14.—1. $\frac{7}{48}$ in. 2. \$.01 a mile. 3. \$18.

Page 15.—4. \$3.65. 5. 4 min. 40 sec. 6. \$30. 7. 1 ft. 5 in. 8. \$3.50. 9. \$15. 10. \$6.75. 11. \$2.45. 12. \$8.45.

Page 16.—1. $1\frac{3}{4}$. 2. $10\frac{1}{5}$. 3. $13\frac{2}{3}$. 4. $\frac{3}{4}$. 5. $1\frac{1}{3}$. 6. $1\frac{1}{2}$. 7. $\frac{1}{2}\frac{3}{4}$. 8. $24\frac{1}{4}$. 9. $16\frac{5}{12}$. 10. $13\frac{1}{4}$. 11. $6\frac{1}{4}$. 12. $7\frac{3}{10}$.

Subtraction: 1. 0. 2. $\frac{1}{3}$. 3. $\frac{2}{3}$. 4. $12\frac{1}{4}$. 5. $7\frac{1}{2}$. 6. $\frac{1}{12}$. 7. $8\frac{3}{5}$. 8. $8\frac{7}{12}$. 9. $6\frac{3}{4}$. 10. $2\frac{9}{10}$. 11. $3\frac{1}{2}$. 12. 0.

Multiplication: 1. $11\frac{2}{3}$. 2. $1\frac{1}{2}$. 3. $8\frac{2}{5}$. 4. $18\frac{3}{4}$. 5. $1\frac{7}{15}$. 6. $2\frac{3}{5}$. 7. $12\frac{1}{2}$. 8. $\frac{1}{5}$. 9. $\frac{5}{28}$. 10. $283\frac{1}{2}$. 11. $22\frac{1}{2}$. 12. $28\frac{2}{3}$.

Division: 1. 16. 2. $1\frac{1}{5}$. 3. $3\frac{2}{3}$. 4. $\frac{2}{11}$. 5. $2\frac{4}{5}$. 6. $\frac{3}{10}$. 7. $\frac{9}{40}$. 8. 2. 9. $\frac{12}{35}$. 10. $2\frac{7}{10}$. 11. $\frac{1}{15}$. 12. $1\frac{3}{44}$.

Page 17.—5. a , $\frac{3}{4}$; b , $\frac{3}{4}$; c , $\frac{2}{5}$; d , $\frac{2}{3}$; e , $\frac{2}{3}$; f , $\frac{3}{4}$; g , $\frac{1}{8}$. 6. a , $1\frac{1}{2}$; b , $2\frac{1}{3}$; c , $2\frac{7}{8}$; d , 2; e , 2; f , $5\frac{1}{2}$; g , $6\frac{1}{2}$; h , $9\frac{2}{5}$; i , 11; j , 7.

Page 18.—13. a , $\frac{4}{3}$; b , $\frac{7}{4}$; c , $\frac{5}{2}$; d , $\frac{10}{3}$; e , $\frac{7}{2}$; f , $\frac{1}{4}$; g , $\frac{2}{7}$.

Page 19.—1. a , $\frac{2}{3}$; b , $\frac{2}{3}$; c , $\frac{4}{5}$; d , $\frac{4}{5}$; e , $\frac{3}{4}$. 2. a , $\frac{2}{4}$, $\frac{5}{10}$; b , $\frac{1}{8}$, $\frac{9}{12}$; c , $\frac{6}{10}$, $\frac{9}{15}$; d , $\frac{21}{24}$, $\frac{1}{6}$; e , $\frac{5}{20}$, $\frac{2}{4}$; f , $\frac{12}{18}$, $\frac{20}{30}$. 3. a , $1\frac{1}{3}$; b , $1\frac{1}{8}$; c , $1\frac{2}{3}$; d , $3\frac{1}{2}$; e , 2; f , $1\frac{5}{8}$; g , 1; h , 3. 4. a , $\frac{4}{3}$; b , $\frac{4}{3}$; c , $\frac{20}{3}$; d , $\frac{23}{5}$; e , $\frac{45}{8}$. 5. a , $4\frac{3}{2}$; b , $1\frac{5}{4}$; c , $5\frac{5}{3}$; d , $3\frac{10}{8}$; e , $4\frac{5}{8}$; f , $7\frac{3}{4}$. 6. a , 6; b , 8; c , $15\frac{5}{7}$; d , $17\frac{1}{2}$. 7. a , $\frac{2}{6}$; b , $\frac{5}{8}$; c , $\frac{4}{8}$; d , $\frac{15}{24}$; e , $\frac{9}{12}$; f , $\frac{8}{12}$. 8. $\frac{6}{24}$, $\frac{4}{24}$, $\frac{3}{24}$. 9. $\frac{10}{20}$, $\frac{8}{20}$, $\frac{15}{20}$. 10. $\frac{1}{4}$, $\frac{1}{8}$, $\frac{1}{3}$, $\frac{5}{8}$.

Page 20.— a , $10\frac{1}{24}$; b , $4\frac{23}{24}$.

Page 21.—Set I: 1. a , $\frac{2}{3}$; b , $\frac{3}{4}$; c , 1; d , $1\frac{1}{2}$; e , $1\frac{1}{2}$; f , $\frac{3}{4}$; g , $\frac{2}{3}$. 2. a , $5\frac{1}{4}$; b , $7\frac{3}{4}$; c , $5\frac{2}{3}$; d , $11\frac{1}{2}$; e , $6\frac{3}{4}$; f , $1\frac{1}{8}$; g , $1\frac{1}{6}$. 3. a , $5\frac{2}{3}$; b , $9\frac{1}{2}$; c , 10; d , $6\frac{1}{2}$; e , $8\frac{3}{4}$; f , $1\frac{1}{3}$; g , $1\frac{1}{6}$.

Set II: 1. a , $5\frac{5}{8}$; b , $4\frac{1}{3}$; c , $3\frac{3}{4}$; d , $11\frac{1}{4}$; e , $10\frac{1}{2}$; f , $\frac{7}{12}$; g , $1\frac{1}{5}$. 2. a , $5\frac{2}{3}$; b , $8\frac{2}{3}$; c , $5\frac{1}{2}$; d , $11\frac{1}{2}$; e , $13\frac{1}{2}$; f , $1\frac{1}{4}$; g , $1\frac{1}{10}$. 3. a , $8\frac{1}{6}$; b , $4\frac{1}{6}$; c , $5\frac{1}{2}$; d , $3\frac{1}{4}$; e , $7\frac{1}{4}$; f , $7\frac{2}{3}$; g , $10\frac{3}{8}$.

Page 22.—1. $2\frac{1}{5}$ sec. 2. $1\frac{3}{5}$ sec. 3. $1\frac{1}{2}$ in. 4. $2\frac{1}{2}$ in. less; $3\frac{3}{4}$ in. beyond; $8\frac{1}{4}$ in.

Page 23.—Set I: 1. a , $\frac{1}{3}$; b , $\frac{2}{3}$; c , 0; d , $4\frac{1}{5}$; e , 6; f , $5\frac{1}{2}$; g , $7\frac{1}{2}$. 2. a , $7\frac{3}{4}$; b , $2\frac{1}{2}$; c , $\frac{1}{8}$; d , $2\frac{3}{5}$; e , 5; f , $\frac{5}{8}$; g , $2\frac{3}{5}$.

Set II: 1. a , $6\frac{2}{3}$; b , $7\frac{1}{2}$; c , $11\frac{5}{6}$; d , $\frac{2}{3}$; e , $6\frac{1}{3}$; f , $7\frac{1}{6}$; g , $6\frac{1}{2}$. 2. a , $\frac{1}{6}$; b , $\frac{1}{3}$; c , $3\frac{3}{8}$; d , $\frac{1}{4}$; e , $8\frac{1}{4}$; f , $5\frac{5}{8}$; g , $7\frac{1}{3}$.

Set III: 1. a , $\frac{1}{12}$; b , $\frac{1}{24}$; c , $3\frac{7}{24}$; d , $7\frac{11}{24}$; e , $\frac{19}{24}$; f , $6\frac{23}{24}$; g , $5\frac{5}{12}$. 2. a , $7\frac{1}{30}$; b , $6\frac{1}{24}$; c , $6\frac{1}{12}$; d , $7\frac{5}{8}$; e , $7\frac{7}{8}$; f , $6\frac{7}{12}$; g , $3\frac{5}{15}$.

Page 24.—8. $\frac{7}{2}$; $\frac{29}{8}$; $\frac{17}{8}$; $\frac{55}{8}$; $\frac{31}{4}$; $\frac{27}{8}$; $\frac{7}{8}$; $\frac{13}{8}$.

Page 25.—2. $\frac{2}{3}$. 3. \$3.33. 4. \$1.50. 5. 60¢. 6. 50¢–32¢; 75¢–50¢; \$1.00–\$.67; \$1.15–\$.80; \$1.50–\$1.00; \$2.00–\$1.34. 7. \$16; \$20; \$24; \$28; \$40; \$72.

Page 26.—Set I: 1. a , 2; b , $\frac{1}{4}$; c , $\frac{4}{5}$. 2. a , $6\frac{1}{5}$; b , $16\frac{2}{3}$; c , $\frac{7}{10}$. 3. a , $\frac{9}{7}$; b , 1; c , 2. 4. a , $2\frac{4}{5}$; b , $1\frac{1}{2}$; c , $\frac{1}{5}$. 5. a , $\frac{1}{12}$; b , $\frac{2}{7}$; c , $\frac{5}{27}$.

Set II: 1. a , 18; b , $21\frac{2}{3}$; c , $37\frac{1}{2}$. 2. a , $8\frac{4}{5}$; b , $56\frac{7}{10}$; c , $2\frac{11}{10}$. 3. a , $\frac{7}{9}$; b , $12\frac{3}{4}$; c , $36\frac{3}{4}$. 4. a , $37\frac{1}{3}$; b , 54; c , $2\frac{7}{12}$. 5. a , $\frac{7}{8}$; b , $\frac{2}{3}$; c , $8\frac{2}{5}$.

Set III: 1. a , $\frac{29}{27}$; b , $\frac{7}{12}$; c , 2. 2. a , $2\frac{2}{3}$; b , $8\frac{2}{3}$; c , $8\frac{1}{2}$. 3. a , $5\frac{5}{8}$; b , 40; c , $12\frac{1}{2}$. 4. 132. 5. 590. 6. $397\frac{1}{3}$. 7. $573\frac{3}{4}$. 8. $955\frac{1}{5}$.

Page 27.—1. \$21,600. 2. \$2,040. 3. $11\frac{1}{4}$ acres. 4. $18\frac{3}{4}$ acres. 5. $16\frac{7}{8}$ acres. 6. $11\frac{1}{4}$ acres. 7. $13\frac{1}{8}$ acres. 8. $71\frac{1}{4}$ acres. 9. $4\frac{3}{4}$ acres.

Page 28.—Comparing by Subtraction: 1. $3\frac{3}{4}$ lb. 2. $1\frac{3}{5}$ sec. Comparing by Ratio: 5. $\frac{1}{6}$. 6. $\frac{1}{8}$; $\frac{3}{8}$; $\frac{5}{8}$; $\frac{2}{3}$; $\frac{5}{6}$. 7. $\frac{1}{8}$ mi.; $\frac{1}{2}$ mi.

Page 29.—6. $\frac{3}{2}$; $\frac{4}{3}$; $\frac{2}{5}$; $\frac{1}{6}$; $\frac{1}{15}$; $\frac{5}{4}$; $\frac{1}{3}$; $\frac{3}{20}$.

Page 30.—Set I: 1. a , 12; b , $8\frac{1}{3}$; c , 16. 2. a , $12\frac{1}{2}$; b , $2\frac{1}{3}$; c , $3\frac{1}{2}$. 3. a , $\frac{2}{3}$; b , $\frac{1}{2}$; c , 1. 4. a , $21\frac{1}{5}$; b , $2\frac{7}{9}$; c , 5. 5. a , $2\frac{2}{3}$; b , 5; c , $16\frac{1}{3}$.

Set II: 1. a , $\frac{1}{4}$; b , $\frac{5}{18}$; c , $\frac{1}{8}$. 2. a , $\frac{3}{28}$; b , $\frac{3}{4}$; c , $\frac{1}{8}$. 3. a , $\frac{4}{21}$; b , $\frac{1}{10}$; c , $1\frac{7}{18}$. 4. a , $2\frac{1}{5}$; b , $\frac{1}{2}$; c , $\frac{1}{4}$. 5. a , $\frac{3}{16}$; b , $\frac{5}{16}$; c , $\frac{5}{16}$.

Set III: 1. a , $\frac{9}{8}$; b , $\frac{2}{3}$; c , 4. 2. a , $1\frac{9}{11}$; b , $2\frac{8}{11}$; c , 1. 3. a , $\frac{1}{25}$; b , $\frac{1}{5}$; c , 1. 4. a , $21\frac{9}{7}$; b , 3; c , 4. 5. a , 2; b , $3\frac{1}{3}$; c , 5.

Page 31.—1. $306\frac{1}{4}$ cu. ft. (245 bu.). 2. 672 cu. in. 3. 2,700 cu. ft. 4. $114\frac{7}{12}$ cu. ft. 5. 2,100 cu. in. 6. $25\frac{3}{7}$ cu. ft. 7. 4,400 cu. ft. 8. 525 cu. ft.

Page 32.—1. 21¢. 2. 32¢. 3. 53¢. 4. \$1.38. 5. 60¢. 6. 90¢. 7. 45¢. 8. 60¢. 9. 67¢. 10. \$4.24. 11. \$1.50. 12. 68¢. 13. \$1.28. 14. $9\frac{3}{5}$ oz.; 12 oz.; 6 oz. 15. 37¢; 45¢. 16. \$16. 17. 27¢.

Page 33.—1. $\frac{11}{12}$. 2. $8\frac{1}{8}$. 3. $4\frac{1}{2}$. 4. $\frac{7}{22}$. 5. $\frac{2}{3}$. 6. $10\frac{1}{6}$. 7. $5\frac{5}{8}$. 8. 12. 9. $24\frac{2}{5}$. 10. $3\frac{3}{5}$. 11. $6\frac{1}{36}$. 12. $1\frac{1}{4}$.

Page 34.—Oral.

Page 35.—4. $\frac{1}{10}$; 10 times. 5. $\frac{1}{100}$. 6. $\frac{1}{1000}$. 7. $\frac{3}{10}$ of a dollar.

8. .5 ft.; \$.011; .98 yd. 9. *a*, 590, 59, 5.9, .59, .059; *b*, 48.6, 25, 3.75, .98, .497; *c*, 875; 64.2; .984, .1, .002; *d*, 970, 64.5, 7, 6.89, .091.

Page 36.—2. $\frac{3}{8}$. 3. $3\frac{1}{4}$. 4. *a*, $\frac{1}{4}$; *b*, $\frac{12}{25}$; *c*, $\frac{7}{10}$; *d*, $\frac{5}{8}$; *e*, $\frac{1}{8}$; *f*, $\frac{1}{25}$; *g*, $\frac{1}{10}$; *h*, $\frac{3}{8}$. 5. *a*, $\frac{1}{8}$; *b*, $\frac{1}{3}$; *c*, $\frac{2}{3}$; *d*, $\frac{3}{8}$; *e*, $\frac{3}{4}$; *f*, $\frac{7}{8}$; *g*, $\frac{5}{8}$; *h*, $\frac{1}{3}$. 6. *a*, $1\frac{1}{4}$; *b*, $3\frac{3}{4}$; *c*, $4\frac{5}{8}$; *d*, $8\frac{1}{3}$; *e*, $7\frac{2}{3}$; *f*, $4\frac{1}{125}$.

Page 37.—4. *a*, .6; *b*, .75; *c*, .25; *d*, .5; *e*, .2; *f*, .4; *g*, .85; *h*, .64; *i*, .98; *j*, .15; *k*, .08; *l*, .625. 5. *a*, $.666\frac{2}{3}$; *b*, .125; *c*, $.444\frac{4}{9}$; *d*, $.583\frac{1}{3}$; *e*, $.533\frac{1}{3}$; *f*, $.611\frac{1}{3}$; *g*, .875. 6. *a*, 2.75; *b*, 7.5; *c*, $6.3\frac{1}{3}$; *d*, 7.375; *e*, $5.83\frac{1}{3}$; *f*, $9.6\frac{2}{3}$ or $9.66\frac{2}{3}$.

Page 38.—2. .1 ft. is .2 in. longer than 1 in.; Same. 3. 18 in. 4. 38.66 ft. 5. 232.08 ft. 6. .38 ft. 7. *a*, 4.8 ft., 5 ft.; *b*, 5.3 ft., 5 ft.; *c*, 6.4 ft., 6 ft.; *d*, 4.7 ft., 5 ft.; *e*, 7.1 ft., 7 ft.

Page 39.—Addition: 1. .7. 2. .22. 3. 1.9. 4. 13.2. 5. .88. 6. 14.15. 7. 1.52. 8. 13.475. 9. .08. 10. 19.47. 11. 110.565. 12. 14.615.

Subtraction: 1. .5. 2. .05. 3. 6.5. 4. 24.87. 5. 0. 6. .21. 7. 13.7. 8. .07. 9. .09. 10. .15. 11. 12.87. 12. .125. 13. .9. 14. .425. 15. 3.25. 16. 3.874. 17. .23. 18. .692. 19. 12.975. 20. .048.

Page 40.—1. Helen's father. 2. 285.6 mi.; 114.2 mi.; 258.5 mi.; 210.9 mi. 3. 1119.8 mi. 4. 223.96 mi. 5. 147.5 mi. 6. 15.67 mi.

Page 41.—1. 1.23. 2. 17.5. 3. 3.084. 4. .6992. 5. 20.8. 6. .792. 7. .075. 8. 98.55. 9. 1.04. 10. 2.920. 11. .02292. 12. 18.944. 13. .235. 14. 23.436. 15. 587.50. 16. .84. 17. \$10.80. 18. \$1.82. 19. *a*, .12; *b*, 125.

Page 42.—2. 6.25. 3. 1.44. 4. 1.69. 5. 4.2. 6. 2.4. 7. .414. 8. 13.53. 9. .12. 10. 22.4. 11. 7.35. 12. .099. 13. 6.38. 14. .699. 15. 1.56. 16. 6.24. 17. 2.25. 18. 1.8.

Page 43.—Set I: 1. *a*, .9; *b*, .6; *c*, .4. 2. *a*, .04; *b*, .06; *c*, .63. 3. *a*, .006; *b*, .008; *c*, .032. 4. *a*, 3; *b*, .2; *c*, .040. 5. *a*, 39.2; *b*, 23.4; *c*, 68. 6. *a*, 23.48; *b*, 58.86; *c*, 47.658. 7. *a*, 228; *b*, 63; *c*, 21.6. 8. *a*, 5.6; *b*, .18; *c*, .042.

Set II: 1. *a*, .08; *b*, .28; *c*, .42. 2. *a*, .005; *b*, .036; *c*, .048. 3. *a*, .45; *b*, .2; *c*, .26. 4. *a*, .1875; *b*, .2772; *c*, .7587. 5. *a*, .42; *b*, .54; *c*, 2.24. 6. *a*, 22.78; *b*, 5.22; *c*, 14.88. 7. *a*, 9.802; *b*, 20.732; *c*, 3.427. 8. *a*, .49; *b*, .048; *c*, .6.

Set III: 1. *a*, .1; *b*, .06; *c*, .024. 2. *a*, .2051; *b*, 16; *c*, 17.28. 3. *a*, .056; *b*, 9.75; *c*, .5663. 4. *a*, 130.53; *b*, 7.84; 36.45. 5. *a*, 36.8; *b*, 2.1; *c*, .05. 6. *a*, 68.4; *b*, 45.99; *c*, .0670. 7. *a*, .3085; *b*, 6; *c*, .0135. 8. *a*, .15; *b*, 5.8158; *c*, .006.

Page 44.—1. $\frac{1}{10}$; $\frac{1}{2}$.

2. Cents.....	50	25	75	$12\frac{1}{2}$	$37\frac{1}{2}$	20	$16\frac{2}{3}$	$33\frac{1}{3}$
Fraction of \$1.00...	$\frac{1}{2}$	$\frac{1}{4}$	$\frac{3}{4}$	$\frac{1}{8}$	$\frac{3}{8}$	$\frac{1}{5}$	$\frac{1}{6}$	$\frac{1}{3}$

3. \$9. 4. \$6. 5. \$11. 6. *a*, \$17; *b*, \$6; *c*, \$9; *d*, \$21; *e*, \$40; *f*, \$212; *g*, \$493; *h*, \$24; *i*, \$8; *j*, \$121; *k*, \$39; *l*, \$18; *m*, \$160; *n*, \$12; *o*, \$27; *p*, \$7; *q*, \$213; *r*, \$351.

Page 46.—1. *a*, 90, 900, 9,000; *b*, 350, 3,500, 35,000; *c*, 648, 6,480, 64,800; *d*, 9, 90, 900; *e*, 12.7, 127, 1,270; *f*, 9.65, 96.5, 965; *g*, 18, 180, 1,800. 2. *a*, .9, .09, .009; *b*, 3.5, .35, .035; *c*, 6.48, .648, .0648; *d*, .09, .009, .0009; *e*, .127, .0127, .00127; *f*, .0965, .00965, .000965, *g*, .18, .018, .0018. 3. 6.3 cents. 4. \$5.60. 5. 14 bu. 6. .34 lb. 7. \$.036. 8. \$3.60; \$36; \$.36. 9. \$.2. 10. \$.0135. 11. \$.0118; \$.118. 12. By 10: 1,250, 125, 12.5, 1.25; by 100: 12,500, 1,250, 125, 12.5; by 1,000: 125,000, 12,500, 1,250, 125. 13. By 10: 12.5, 1.25, .125, .0125; by 100: 1.25, .125, .0125, .00125; by 1,000: .125, .0125, .00125, .000125.

Page 47.—1. 230. 2. 1,000. 3. 3,800. 4. 635. 5. 3,700. 6. 36,950. 7. 10,000. 8. 1,100. 9. 1,600. 10. 1,200. 11. 2,000. 12. 4,850. 13. 2,800. 14. 9,935. 15. 21,525. 16. 650. 17. 9,600. 18. 32,450. 19. 241,700. 20. 496,000. 21. 29,700.

Page 49.—1. 3.2. 2. 9.05625. 3. 62. 4. 33. 5. 937.2. 6. 404.286. 7. .21. 8. 327.231. 9. 24.342.

How to Use Zeros: 1. .0079. 2. .039. 3. .0048. 4. .73. 5. 2155.522. 6. .045. 7. .0429. 8. .0284. 9. .65. 10. 5. 11. .06953. 12. .03025.

Page 50.—1. 31.2. 2. 312. 3. 31.2. 4. 3.12. 5. 31.2. 6. 312. 7. 31,200. 8. 3,120. 9. 312. 10. .312. 11. .312. 12. .00312. 13. .0312. 14. 3,120. 15. 3.12. 16. 3.12. 17. .0312. 18. 3.12.

Proving Quotients: 2. 50. 3. 7.2. 4. 102. 7. .12. 10. 64. 12. 25. All others are correct.

Page 51.—2. 13. 3. 2. 4. 1.3. 5. 3.4. 6. 28. 7. 3.6. 8. .15. 9. 2.8. 10. 2.4. 11. 12.5. 12. 7.6.

Special practice: 1. \$500. 2. \$40. 3. \$12. 4. \$2,000. 5. \$151.50. 6. \$72. 7. \$182. 8. \$300. 9. \$30,000. 10. \$53.50. 11. \$20. 12. \$12.50. 13. \$41. 14. \$790. 15. \$984.75.

Page 52.—1. 1.2. 2. .3. 3. .5. 4. .03. 5. 3.6. 6. 1.59. 7. .19. 8. .175. 9. .004. 10. .05. 11. .25. 12. 3.407. 13. 4.246. 14. .3. 15. .04. 16. .201. 17. 11. 18. 61.2. 19. 3. 20. 20. 21. 50. 22. 7.5. 23. 12. 24. 13.1. 25. 50. 26. 20. 27. 75. 28. 5.4. 29. 1.1. 30. 230. 31. 53.772. 32. 1.148.

Page 53.—1. 2.55 in. 2. 13.1 in. 3. 6 times. 4. 23.09 in.; about 5 times. 5. 3.50 in. 6. Jan., 3.5; Feb., 1.0; Mar., 2.0; Apr., 3.0; May, 4.0; June, 5.0; July, 5.0; Aug., 6.0; Sept., 6.0; Oct., 4.5; Nov., 6.0; Dec., 5.5. 7. About $51\frac{1}{2}$ in. 8. Heaviest in 1921 and 1911; lightest in 1931 and 1906.

Page 54.—3. 16.8. 4. 3.2. 5. 25.92. 6. 14.92. 7. 32. 8. 51.2. 9. 2.88. 10. 6.8. 11. 161.6. 12. 203.76. 13. 21. 14. 18. 15. 29.16. 16. 39.24. 17. 32.94. 18. 1,900. 19. 25.38. 20. 812.5. 21. 34.96. 22. 429.84. 23. 3,100. 24. 39.28. 25. 23,950. 26. 69.76. 27. 21,400. 28. 13,950. 29. 12,450.

Page 55.—1. \$31. 2. 16 yd. 3. \$23. 4. Oral. 5. \$32.50. 6. \$5,625. 7. 6.75 cwt. 8. 190 tickets. 9. 30 hr. 10. \$8. 11. 500 miles. 12. \$20. 13. \$375; \$500; \$750; \$1,000; \$1,500; \$2,250; \$3,000; \$3,750.

Page 56.—Fractions: 1. $\frac{5}{24}$. 2. $1\frac{7}{2}$. 3. 16. 4. $2\frac{2}{3}$. 5. 14. 6. $3\frac{1}{4}$. 7. $9\frac{1}{2}$. 8. $\frac{21}{22}$. 9. $8\frac{1}{2}$. 10. $8\frac{1}{24}$. 11. 54. 12. $\frac{1}{6}$.

Decimals: 1. 18.3. 2. 23.82. 3. 34.245. 4. 71.1. 5. 32.088. 6. 20.468. 7. 3. 8. 4.48. 9. 2.252. 10. 1.83. 11. 4.15. 12. 6,402. 13. .875. 14. $6\frac{3}{4}$.

Special Practice: 1. .50; .25; .75. 2. $.33\frac{1}{3}$; $.66\frac{2}{3}$; $.16\frac{2}{3}$. 3. .85; $.53\frac{1}{3}$; .32. 4. .20; .40; .60. 5. $.83\frac{1}{3}$; $.62\frac{1}{2}$; .60. 6. $.08\frac{1}{3}$; $.88\frac{2}{3}$; .60. 7. $.12\frac{1}{2}$; $.37\frac{1}{2}$; $.87\frac{1}{2}$. 8. $.11\frac{1}{9}$; .35; .76. 9. .25; .05; .06.

Page 57.—1. 20¢. 2. 16¢. 3. 12,000 sacks. 4. 6 badges. 5. 30 mi. per hr. 6. \$24. 7. \$18. 8. \$30.875. 9. $1\frac{1}{2}$ or 1.5 times. 10. 54,000 bricks.

SECTION II

Page 59.—1. None. 2. No. 3. \$1.56.

Page 60.—4. Total expenses, \$6.47; cash balance, \$1.53.

1. 30%; $4\frac{1}{6}\%$; $12\frac{1}{2}\%$.

2.

19—		MONEY RECEIVED		19—		MONEY SPENT	
Oct.	1	Cash balance on hand	\$1 53	Oct.	2	Church	\$ 10
"	1	Delivering papers	2 00	"	9	"	10
"	8	" "	2 00	"	16	"	10
"	15	" "	2 00	"	23	"	10
"	22	" "	2 00	"	30	"	10
"	29	" "	2 00			Car fare, 6 round trips	84
		Running errands	50			School supplies	20
						Football game	50
						Deposited in savings bank	3 00
				"	30	Cash balance	6 99
			12 03				12 03
Nov.	1	Cash balance on hand	6 99				

Page 61.—2. Balance, \$8.88. 3. \$6.85.

Page 63.—Oral.

Page 64.—Oral.

Page 65.—3. Fraction for Rent: $\frac{1}{4}$, $\frac{1}{5}$, $\frac{1}{5}$, $\frac{1}{5}$; for Clothing: $\frac{3}{25}$, $\frac{3}{25}$, $\frac{3}{25}$, $\frac{3}{25}$; for Food: $\frac{2}{5}$, $\frac{3}{5}$, $\frac{4}{25}$, $\frac{3}{10}$; for Insurance and Savings: $\frac{1}{20}$, $\frac{1}{20}$, $\frac{3}{20}$, $\frac{1}{5}$. 4. For miscellaneous: \$270, \$510, \$485, \$540. 5. Monthly: rent, \$31.25; food, \$50; clothing, \$15; insurance and savings, \$6.25; miscellaneous, \$22.50. 6. \$25.

Page 66.—3. \$104; \$33; \$48; \$17; \$41.60; \$105; \$65; \$33.75; total, \$447.35.

Page 67.—Oral.

Page 69.—1. a, 850 cu. ft.; b, 525 cu. ft.; c, 3,400 cu. ft.

Page 70.—1. \$2.60. 2. Jan., 2,300 cu. ft.; Feb., 1,900 cu. ft.; Mar., 2,800 cu. ft.; Apr., 2,700 cu. ft.; May, 1,200 cu. ft.; June, 2,400 cu. ft. Jan., \$1; Feb., \$1; Mar., \$1.12; Apr., \$1.08; May, \$1; June, \$1. 3. 7.8¢ or 8¢. 4. 416.7 cu. ft.

CAN. A.

Page 72.—2. Jan., \$2.45; Feb., \$3.01; Mar., \$1.89; Apr., \$2.10; May, \$2.31.

Page 73.—5. .365 kw. hr. 6. .35 kw. hr. 7. \$.25. 8. 12¢. 9. 68¢.

Page 74.—2. 11,000 cu. ft. 3. 12,500 gal. 4. Jan., 3,600 cu. ft.; Feb., 3,100 cu. ft.; Mar., 3,500 cu. ft.; Apr., 3,900 cu. ft.; May, 3,200 cu. ft.; June, 3,200 cu. ft. Jan., \$5.63; Feb., \$4.84; Mar., \$5.47; Apr., \$6.09; May, \$5; June, \$5; Total, \$32.03.

Page 75.—Practice Test in Fractions: 1. $\frac{2}{3}$. 2. $1\frac{7}{24}$. 3. $1\frac{1}{3}$. 4. $66\frac{2}{3}$. 5. $7\frac{1}{12}$. 6. $11\frac{3}{4}$. 7. 3. 8. 24. 9. 10. 10. $11\frac{7}{8}$. 11. $12\frac{11}{12}$. 12. $2\frac{1}{2}$.

Practice Test in Decimals: 1. 22.2. 2. 32.075. 3. 24.655. 4. 61.6. 5. 15.375. 6. 18.55. 7. .98. 8. 7.872. 9. 61.5. 10. .27. 11. 61.1. 12. 20. 13. .875; $\frac{1}{8}$.

SECTION III

Page 77.—1. 35%; 27%; 46%; 6%; 2%; 20%; 30%; 11%; 33%. 2. $.45, \frac{9}{20}$; $.35, \frac{7}{20}$; $.6, \frac{3}{5}$; $.4, \frac{2}{5}$; $.27, \frac{27}{100}$; $.15, \frac{3}{20}$; $.05, \frac{1}{20}$; $.07, \frac{7}{100}$. 3. .03. 4. .45.

Page 78.—5. .6. 7. $37\frac{1}{2}\%$; 60%; 4%; 140%; 125%; 16%; 30%; 270%; $4\frac{1}{2}\%$; $62\frac{1}{2}\%$; $\frac{1}{2}\%$. 9. .45; .375; .625; .04; .2; .035; .045; 1.25; .005. 10. $.85, \frac{17}{20}$. 11. $\frac{97}{100}$, .97, 97%. 12. .1, $\frac{1}{10}$. 14. .4 is more.

Page 79.—

BANNER

TABLE

FRACTION	DECIMAL	PER CENT	FRACTION	DECIMAL	PER CENT
$\frac{1}{8}$	.12 $\frac{1}{2}$	12 $\frac{1}{2}$	$\frac{3}{8}$	.375	37 $\frac{1}{2}$
$\frac{1}{4}$	.25	25	$\frac{1}{2}$	.5	50
$\frac{3}{8}$	.75	75	$\frac{1}{7}$	.14 $\frac{2}{7}$	14 $\frac{2}{7}$
$\frac{1}{2}$	.20	20	$\frac{1}{20}$	.05	5
$\frac{5}{8}$	.875	87 $\frac{1}{2}$	$\frac{3}{50}$	.06	6
$\frac{1}{3}$	.33 $\frac{1}{3}$	33 $\frac{1}{3}$	$\frac{7}{20}$	.35	35
$\frac{2}{3}$	.375	37 $\frac{1}{2}$	$\frac{6}{25}$	.24	24
$\frac{4}{5}$	.80	80	$\frac{2}{5}$	.6	60
$\frac{1}{6}$	.16 $\frac{2}{3}$	16 $\frac{2}{3}$	$\frac{3}{5}$	.03 $\frac{1}{3}$	3 $\frac{1}{3}$
$\frac{1}{2}$	.5	50	$\frac{1}{30}$	.55 $\frac{5}{9}$	55 $\frac{5}{9}$

2. $\frac{1}{4}$, .25, 25%. 3. $\frac{1}{5}$, .2, 20%. 4. $\frac{1}{4}$, .25, 25%. 5. $\frac{1}{2}$, .5, 50%. 6. $\frac{1}{3}$, $.33\frac{1}{3}$, 33 $\frac{1}{3}\%$. 7. $\frac{1}{3}$, $.33\frac{1}{3}$, 33 $\frac{1}{3}\%$. 8. $\frac{1}{6}$, $.16\frac{2}{3}$, 16 $\frac{2}{3}\%$. 9. $\frac{3}{4}$, .75, 75%. 10. $\frac{3}{4}$, .75, 75%. 11. $\frac{1}{8}$, .125, 12 $\frac{1}{2}\%$. 12. $\frac{3}{8}$, .375, 37 $\frac{1}{2}\%$. 13. $\frac{1}{5}$, .20, 20%. 14. $\frac{4}{5}$, .8; 80%. 15. $\frac{1}{8}$, .125, 12 $\frac{1}{2}\%$. 16. $\frac{1}{10}$, .1, 10%.

Page 80.—2. 40. 3. 20. 4. 100%. 6. \$5.20; \$7.60. 7. 100%. 8. Yes; \$1.04 less. 9. 100%. 10. 100%.

Page 81.—2. 25%. 3. 62 $\frac{1}{2}\%$. 4. 75%. 5. 25%. 6. 125%. 7. 51%; 49%. 8. 44.1%; 55.9%. 9. 69%, 31%.

Page 82.—1. 138 books. 2. 36 pupils. 3. 36 chickens. 4. 5 lb. 5. a, 65; b, 2.8; c, 60 lb. 6. a, 7.5; b, 5.4 bu.; c, 112.5 lb. 7. a, 12; b, 110; c, 1.65. 8. a, 31.5; b, 3.8; c, 1.48. 9. a, 631.5 gal.; b, 180 lb.; c, 195.2. 10. a, 173; b, 312; c, 150. 11. a, 25; b, 300; c, 360. 12. a, 120; b, 50; c, 40.

Page 83.—1. \$.36. 2. \$20. 3. \$24. 4. \$1,890. 5. \$26.40. 6. \$2; \$8. 7. \$.80; \$.80. 8. \$1.50; \$9. 9. \$.25; \$6.50. 10. \$18.75; \$143.75. 11. \$20; \$180. 12. \$4,500.

Page 84.—2. 3 times; 4 times; 6 times; 10 times; 12 times. 3. 24,000. 4. Production was 4 times as great as formerly. 5. The father weighs 300% of John's weight. 6. Harry's salary had increased 100% in five years. 7. 300% of \$50; 500% of \$64; 1100% of \$80. 8. 110.40 lb.

Page 85.—10. 400%. 11. .65. 12. 1.10. 13. .07. 14. .2. 15. 2.56. 16. 3. 17. 8.5. 18. .06. 19. 10. 20. 1.06. 21. .94. 22. .07. 23. .085. 24. 1.165. 25. .175. 26. 45%. 27. 146%. 28. 300%. 29. 8%. 30. 250%. 31. 137%. 32. 140%. 33. 500%. 34. 1,325%. 35. 280%. 36. 1,458. 37. 3,510. 38. 69.02. 39. 2,032.75. 40. 1,092. 41. 825.12. 42. 3,372. 43. 916.80. 44. \$51.52.

Set I: Per Cents: 1. 4%. 2. 117%. 3. 75%. 4. 162.5%. 5. 50%. 6. 37 $\frac{1}{2}$ %. 7. 140%. 8. 166 $\frac{2}{3}$ %. 9. 3 $\frac{1}{2}$ %. 10. 17 $\frac{1}{2}$ %. 11. 400%. 12. $\frac{1}{2}$ %.

Decimals: 1. .07. 2. .125. 3. .18. 4. .2. 5. .0025. 6. .33 $\frac{1}{3}$. 7. 1.164. 8. 1.03. 9. 1.585. 10. 3. 11. .005. 12. .034.

Page 86.—Hundredths and Per Cents: 1. .50, 50%. 2. .33 $\frac{1}{3}$, 33 $\frac{1}{3}$ %. 3. .80, 80%. 4. .70, 70%. 5. .32, 32%. 6. .02, 2%. 7. .87 $\frac{1}{2}$, 87 $\frac{1}{2}$ %. 8. .62 $\frac{1}{2}$, 62 $\frac{1}{2}$ %. 9. .25, 25%. 10. .83 $\frac{1}{3}$, 83 $\frac{1}{3}$ %.

Set II: 1. 3.2. 2. 86. 3. 80. 4. 28. 5. 140. 6. 15. 7. 15. 8. 5.04. 9. 130. 10. 183. 11. 35. 12. 142.83. 13. 15.33. 14. 19.65. 15. 3.825. 16. 318. 17. 365. 18. 82 $\frac{5}{8}$. 19. 412.32. 20. 35.585. 21. 57.72. 22. 450.

Set III: 1. 72. 2. 312. 3. 716.8. 4. 576. 5. 1,200. 6. 2,390. 7. 2,100. 8. 1,446. 9. 925.55. 10. 1,233. 11. 1,064. 12. 900. 13. 661.8. 14. 2131.5. 15. 3,600. 16. 1936.4. 17. 1254.14. 18. 131.25. 19. 1,040. 20. 854.44. 21. 23,805. 22. 4,194.

Page 87.—1.

12 $\frac{1}{2}$ %	16 $\frac{2}{3}$ %	25%	33 $\frac{1}{3}$ %	37 $\frac{1}{2}$ %	62 $\frac{1}{2}$ %	66 $\frac{2}{3}$ %	87 $\frac{1}{2}$ %
$\frac{1}{8}$	$\frac{1}{6}$	$\frac{1}{4}$	$\frac{1}{3}$	$\frac{3}{8}$	$\frac{5}{8}$	$\frac{2}{3}$	$\frac{7}{8}$

2. $\frac{1}{8}$ less. 3. $\frac{5}{6}$, or 83 $\frac{1}{3}$ %. 4. $\frac{1}{8}$ or 12 $\frac{1}{2}$ %. 5. 5¢, 25¢. 6. 15¢, 30¢. 7. \$.33, \$.55. 8. \$.75, \$.45. 9. \$1.60, \$.80. 10. \$4.20, \$.60. 11. \$.750, \$.52.50. 12. \$12.75, \$38.25. 13. \$.10, \$.70. 14. \$.20, \$.40. 15. \$12.50, \$62.50. 16. \$.45, \$.75. 17. \$.225, \$1.35. 18. \$.320, \$1.60. 19. \$11.90, \$1.70. 20. \$.18, \$.36.

Page 88.—Oral.

Page 89.—4. $\frac{3}{4}$, .75, 75%. 5. $\frac{3}{4}$, .75, 75%. 6. $\frac{5}{4}$, 1.25, 125%. 7. $\frac{1}{5}$, .20, 20%. 8. $\frac{1}{6}$, .16 $\frac{2}{3}$, 16 $\frac{2}{3}$ %. 9. $\frac{5}{8}$, .83 $\frac{1}{3}$, 83 $\frac{1}{3}$ % of former length. 10. Speed of automobile to speed of man is 10 to 1.

Page 90.—5. 20%. 6. 75%. 7. .84, 84%. 8. 37 $\frac{1}{2}$ %. 9. 5%. 10. 33 $\frac{1}{3}$ %. 11. 20%.

Page 91.—12. 160%. 13. 93 $\frac{3}{4}$ %. 14. 25%. 15. 100%. 16. 60%. 17. 37 $\frac{1}{2}$ %. 18. 160%. 19. 150%. 20. Yes. 21. 75%. 22. 80%.

23. 15% absent, 85% present. 24. $46\frac{2}{3}\%$ boys; $53\frac{1}{3}\%$ girls. 25. 80%.
26. 50%.

Set I: 1. $12\frac{1}{2}\%$. 2. 30%. 3. 4%. 4. $12\frac{1}{2}\%$. 5. 26%. 6. 100%.
7. 200%. 8. 125%. 9. $47\frac{2}{3}\%$. 10. 150%.

Set II: 1. 25%. 2. 40%. 3. 3%. 4. $12\frac{1}{2}\%$. 5. 3.2%. 6. $33\frac{1}{3}\%$.
7. 100%. 8. 200%. 9. 135%. 10. $116\frac{2}{3}\%$.

Page 92.—1. 3¢; 6%. 2. 4¢; $8\frac{1}{3}\%$. 3. 2¢; 5%. 4. 18¢; $16\frac{2}{3}\%$.
5. $\frac{1}{2}$ ¢; about .7%. 6. $3\frac{3}{4}$ ¢; $12\frac{1}{2}\%$.

Page 93.—2. a, 80 sheep; b, 150 acres; c, 50 cans; d, 30 pencils;
e, 40 cattle; f, 120 pigs; g, 60 cucumbers. 3. 20 words. 4. a, 50; b, 120;
c, 100; d, 500; e, 90; f, 90; g, 16; h, 160; i, 100; j, 48; k, 50; l, 80.

Page 94.—Set I: 1. 25%. 2. 50%. 3. 2%. 4. $12\frac{1}{2}\%$. 5. 3.8%.
6. $33\frac{1}{3}\%$. 7. 25%. 8. 20%. 9. $33\frac{1}{3}\%$. 10. 15%. 11. 20%. 12. 75%.
13. 30%. 14. 5%. 15. $16\frac{2}{3}\%$. 16. 4.8%.

Set II: 1. 200%. 2. 100%. 3. 125%. 4. $95\frac{5}{13}\%$. 5. $11\frac{4}{11}\%$.
6. $116\frac{2}{3}\%$. 7. 200%. 8. 100%. 9. $116\frac{2}{3}\%$. 10. 25%. 11. 125%.
12. 200%. 13. 100%. 14. 125%. 15. 81%. 16. $33\frac{1}{3}\%$.

Set III: 1. 600. 2. 200. 3. 96. 4. 51. 5. 200. 6. 200. 7. 400.
8. 200. 9. 860. 10. 200. 11. 2,000. 12. 3,000. 13. 800. 14. 320.
15. 80. 16. 1,200. 17. 400. 18. 20,000.

Page 95.—Set IV: 1. 200. 2. $388\frac{2}{3}$. 3. 400. 4. 500. 5. 288. 6. 200.
7. 60. 8. 450. 9. 405. 10. 500. 11. 48. 12. 300. 13. 600. 14. 400.
15. 990. 16. 1,260.

Test I: 1. 10. 2. 138. 3. 50%. 4. $33\frac{1}{3}\%$. 5. $2\frac{1}{2}\%$. 6. 100.
7. 75. 8. 187.2. 9. 40%. 10. 200.

Test II: 1. 4.8. 2. 5%. 3. 25%. 4. \$21. 5. 8. 6. 45. 7. $4\frac{4}{9}\%$.
8. 3.9. 9. $3\frac{3}{8}\%$. 10. 225%.

Test III: 1. 36. 2. $66\frac{2}{3}\%$. 3. \$250. 4. 1.6. 5. 120. 6. $62\frac{1}{2}\%$.
7. 18. 8. \$40.05. 9. 180%. 10. 160%.

Page 96.—1. 2 words. 2. 8%. 3. 50 words. 4. 120 lb. 5. 15 bu.
6. $37\frac{1}{2}\%$. 7. 80%.

Page 97.—1. 3.2 mi. 2. 31.44 mi. 3. \$.98. 4. $\frac{25522}{1145}$, or nearly $\frac{1}{2}$.
5. 109,500 lb. 6. 313.02 mi.; 104.34 mi. 7. \$.134. 8. 3.02 in. 9. .9275
mi.

Page 98.—10. .08 lb. 11. 12.64 bu. 12. \$4.32. 13. .7 yd. is .325 yd.
greater. 14. 800 mi.

Part I: 1. a, 4%; b, 117%; c, 75%; d, $162\frac{1}{2}\%$; e, 50%; f, $37\frac{1}{2}\%$;
g, 140%; h, $166\frac{2}{3}\%$; i, $3\frac{2}{3}\%$; j, $17\frac{1}{2}\%$; k, 400%; l, 160%. 2. a, .07;
b, .125; c, .18; d, .2; e, 1.17; f, $.33\frac{1}{3}$; g, 1.164; h, 1.03; i, 1.585; j, 3;
k, .025; l, .034. 3. b, .20, 20%; c, .32, 32%; d, .06, 6%; e, .625, $62\frac{1}{2}\%$;
f, $.83\frac{1}{3}$, $83\frac{1}{3}\%$.

Page 99.—Part II: 1. 3.2. 2. 86. 3. 80. 4. 28. 5. 140. 6. 15.
7. 15. 8. 72. 9. 312. 10. 716.8. 11. 576. 12. 1,200. 13. 2,390.
14. 2,100.

Part III: 1. 25%. 2. 50%. 3. 2%. 4. $12\frac{1}{2}\%$. 5. 3.8%. 6. $33\frac{1}{3}\%$.
7. 100%. 8. 300%. 9. 125%. 10. $95\frac{5}{13}\%$. 11. 150%. 12. $116\frac{2}{3}\%$.

Part IV: 1. 600. 2. 1,000. 3. 96. 4. 51. 5. 200. 6. 200. 7. 400.
8. 200. 9. 400. 10. 400. 11. 500. 12. 360. 13. 200. 14. 60.

Page 100.—Diagnostic Test I: 1. $9\frac{5}{12}$. 2. $1\frac{5}{8}$. 3. $85\frac{1}{2}$. 4. $1\frac{2}{3}$. 5. $\frac{9}{16}$.
CAN. A.

6. 1.9. 7. 8. 8. 140. 9. 1.25. 10. 107.64. 11. 11.322. 12. 9.49.
13. 26.9. 14. 8.714. 15. 75 is $\frac{1}{2}$, or 50% of 150. 16. 25%. 17. 40.
18. .6363. 19. $\frac{5}{8}$. 20. .005. 21. $7\frac{2}{3}$ ft. 22. \$.75. 23. 598.42. 24. 247,863.
25. 3,349.

Practice Test in Fractions III: 1. $\frac{4}{5}$. 2. $1\frac{17}{28}$. 3. $37\frac{1}{12}$. 4. 105. 5. 8.
6. $\frac{2}{3}$. 7. $16\frac{4}{5}$. 8. $13\frac{19}{24}$. 9. $\frac{4}{5}$. 10. $\frac{1}{20}$. 11. $10\frac{2}{15}$. 12. $5\frac{19}{24}$.

Page 101.—1. \$.30. 2. \$1.70. 3. $36\frac{1}{4}$ lb. 4. $7\frac{1}{4}$ bu. 5. $2\frac{5}{8}$ lb. 6. $\frac{1}{4}$ hr.
(15 min.). 7. \$7.60. 8. 100 bu.; \$120. 9. $2\frac{3}{4}$ yd.

Page 102.—Practice Test in Decimals II: 1. 23. 2. 21.706. 3. 49.303.
4. 10.07. 5. 20.88. 6. 93.358. 7. 17. 8. 6.51. 9. 5.832. 10. 38.2.
11. 7,490. 12. .01652. 13. .9375. 14. $\frac{12}{25}$.

Practice Test in Percentage I: 1. 25%; 20%; 5%; 125%; $67\frac{1}{2}\%$;
 $133\frac{1}{3}\%$. 2. .15; .125; 1.2; .06; .005; .035. 3. \$6.00. 4. 25%. 5. 100.
6. 240. 7. 75. 8. 60%. 9. 40%. 10. 141.

Page 104.—1. \$5.60. 2. 2¢. 3. Lettuce, 2¢; onions, 2¢. 4. 15¢ a pk.
on each. 5. 60%; 100%; $62\frac{1}{2}\%$; 60%. 6. \$4.98. 7. \$8.26. 8. \$3.28.

Page 105.—9. \$1.55. 10. \$1.73. 11. 39.7%. 12. 20.9%.

Page 106.—1. \$2.00. 2. 40% of selling price, $66\frac{2}{3}\%$ of the cost.
3. \$1.00. 4. 100% of the cost, 50% of the selling price. 5. No profit
or loss.

Page 107.—1. $16\frac{2}{3}\%$. 2. $7\frac{1}{2}\%$. 3. 20% gain. 4. 10% gain. 5. 16%
loss. 6. $66\frac{2}{3}\%$ loss. 7. \$375. 8. \$400. 9. \$25; 25%. 10. \$25 loss;
10%. 11. \$330 = s. p.; \$30 profit. 12. \$360 = s. p.; \$40 loss.
13. \$1,200 = cost; \$1,260 = s. p. 14. \$500 = cost; \$460 = s. p.
15. \$50 profit; 20%. 16. \$1,125 = s. p.; \$125 profit.

Page 108.—1. \$18.75.

Page 109.—2. 20%. 3. \$4.50. 4. $81\frac{3}{11}\%$. 5. 45¢. 6. 120 papers.
7. June, \$288; July, \$443.25; Aug., \$369; total, \$1105.25. 8. \$761.73.

Page 110.—9. 69.2%.

Practice in Finding Commissions: 1. \$166.66. 2. \$150. 3. \$250.
4. \$288. 5. \$42. 6. \$8.75. 7. \$93.75. 8. \$356. 9. \$39.20. 10. \$36
11. \$10. 12. \$81.90. 13. \$519.20. 14. \$390. 15. \$32.64. 16. \$18.
17. \$60. 18. \$15. 19. \$30.60. 20. \$48.75.

Page 111.—1. Gross, \$2,150; commission, \$172; total charges, \$545.25;
net proceeds, \$1604.75.

Problems in Net Proceeds:

NUMBER	COMMISSION	NET PROCEEDS
1.	\$15	\$460
2.	\$15	\$712.50
3.	\$6.25	\$106.75
4.	\$56	\$726
5.	\$16.25	\$3,111.75
6.	\$983.33	\$491.67

7. \$331.20. 8. \$5,500.

Page 112.—9. \$8,775. 10. \$1,415. 11. \$22,219. 12. \$9.30. 13. To
Sunshine Magazine, \$37.50; to Home Magazine, \$56.25; to Leader Mag-
azine, \$22.50. 14. \$825; \$550.

Page 113.—1. 5%. 2. 4%. 3. \$3,500. 4. \$2,500. 5. \$12.50. 6. \$13. 7. \$25.20. 8. 5%. 9. $3\frac{1}{2}\%$. 10. \$500. 11. \$420. 12. \$33. 13. 6%. 14. \$310. 15. \$400.

Page 114.—1. \$24; 25%. 2. \$80; 20%. 3. \$50; 20%. 4. \$225; \$250. 5. \$470; \$500. 6. \$75; 20%. 7. \$240; \$60. 8. \$140; 14%. 9. \$3; \$9. 10. \$2; \$18. 11. 20%; \$28. 12. 25%; \$45. 13. \$25; \$20. 14. \$30; \$20. 15. 10%; \$9. 16. \$950. 17. \$70; \$2,930. 18. 4%; \$5,760. 19. 2%; \$735. 20. \$300; \$276. 21. \$610; \$573.40. 22. 10%; \$95. 23. 25%; \$250. 24. \$19; \$456.

Page 116.—1.-3. See bill on p. 115. 6. \$2.72; \$32.64.

7. 25 hatchets.....	@ .40	\$10.00	
30 axes.....	@ .75	22.50	
20 hammers.....	@ .35	7.00	
		39.50	
Discount.....	25%	9.88	
			\$29.62

8. 36. 9. 20%. 10. \$4.80; \$27.20. 11. \$2.40; \$45.60. 12. \$.75; \$3.00. 13. \$.63; \$3.57. 14. \$.14; \$3.36. 15. \$.201; \$4.69. 16. \$.420; \$345.80. 17. \$.45; \$7.05. 18. \$.74; \$8.51. 19. \$28.02.

Page 117.—1. $14\frac{1}{8}$. 2. $245\frac{1}{8}$. 3. 75. 4. $1\frac{1}{5}$. 5. 2. 6. 90. 7. 36.70. 8. 61. 9. .02. 10. 221.93+. 11. 27¢. 12. $33\frac{1}{3}\%$. 13. 200. 14. $20\frac{1}{8}$. 15. .005. 16. 26.775. 17. 1.007. 18. 30.15. 19. 150%. 20. 500 lb.; 4 pt. 21. 470. 22. 354,584. 23. 9,486. 24. $\frac{1}{3}$.

Page 118.—Practice Test in Fractions: 1. $\frac{9}{25}$. 2. $1\frac{1}{8}$. 3. $4\frac{3}{5}$. 4. $\frac{3}{5}$. 5. $3\frac{3}{10}$. 6. $32\frac{1}{3}$. 7. $4\frac{2}{3}$. 8. $68\frac{3}{8}$. 9. $\frac{45}{112}$. 10. 35. 11. $36\frac{5}{12}$. 12. $32\frac{3}{4}$. Practice Test in Decimals: 1. 20.96. 2. 25.26. 3. 45.644. 4. 12.6. 5. 20.966. 6. 45.83. 7. .138. 8. 6.125. 9. 16.368. 10. 2,253. 11. 35,350. 12. .1318. 13. .888 $\frac{3}{8}$. 14. $\frac{5}{8}$.

Page 119.—Practice Test in Percentage: 1. 50%; 25%; $12\frac{1}{2}\%$; 10%; 20%. 2. 5%; 12%; $12\frac{1}{2}\%$; 20%; 140%; $16\frac{2}{3}\%$. 3. 5%; $\frac{5}{100}$; $\frac{1}{20}$. 4. a. .005; .0025; .00125; .001. b. .1875; .15; .275. 5. \$8.40; \$12; 3 lb. 6. $33\frac{1}{3}\%$; 50%; 25%. 7. 75; 100; 200; 400; 5,000.

Review of area and volume: 1. $4\frac{1}{4}$ in. 2. $1\frac{3}{4}$ sq. in. 3. 14.7 sq. in. 4. $69\frac{1}{2}$ cu. in.; 126 cu. in.; $256\frac{1}{2}$ cu. in.

Page 120.—1. 40%. 2. 195 acres. 3. 20¢. 4. 22 boxes. 5. \$4.50. 6. 25%. 7. 405 cu. ft. 8. $31\frac{2}{11}\%$. 9. \$227.90. 10. 29.7 less.

SECTION IV

Page 123.—2. $1\frac{1}{2}$ in. 4. 4 in. 5. $1\frac{1}{2}$ in.

Page 126.—1. b, e; a, d; c, f. 2. Acute. 3. Straight angle; acute angle; obtuse angle; obtuse angle; obtuse angle; acute angle; acute angle. 4. Right angle. 5. Obtuse angle. 8. 3 vertices; 4 vertices; same number of sides.

Page 128.—1. 90°. 2. 72°; 120°. 3. 45°; $22\frac{1}{2}^\circ$; 30°. 4. 90°; 90°; 120°.

Page 129.—6. 90° . 7. 90° ; 180° ; 360° ; 60° ; 150° . 8. 3; 120° . 10; 36° . 8; 45° .

Page 132.—5. 6° .

Page 133.—1.

Actual length.	1'	3'	7'	9'	11'	15'	20'
Scale length..	1"	3"	7"	9"	11"	15"	20"

2. $3'' \times 4''$. 3.

Actual length.	1'	2'	8'	9'	12'	16'	19'
Scale length..	$\frac{1}{2}''$	1"	4"	$4\frac{1}{2}''$	6"	8"	$9\frac{1}{2}''$

4.

Actual length.	2'	4'	8'	10'	10'	17'	24'
Scale length..	$\frac{1}{2}''$	1"	2"	$2\frac{1}{2}''$	$2\frac{1}{2}''$	$4\frac{1}{4}''$	6"

5. $4'' \times 3\frac{1}{2}''$. 6. a, $3'' \times 3\frac{1}{2}''$; b, $5\frac{1}{2}'' \times 5\frac{1}{2}''$.

Page 134.—1. $26'$. 2. 13. 4. $16\frac{2}{3}'' \times 10\frac{3}{4}''$. 5. $2''$; $1\frac{1}{3}''$; $2\frac{2}{3}''$. 6. $24'$; $21'$; $10\frac{1}{2}'$.

Page 136.—1. North, east, south, west. 3. 45° . 6. Spring; Indian village; Farm house.

Page 137.—9. North of east; about 15° .

Page 139.—2. 80° . 3. a, 26° ; b, 66° ; c, 60° ; d, 111° . 4. 90° . 6. 90° .

Page 145.—1. HG, EF and HE, GF are parallel. 2. Parallelogram. 3. Angles a and b are equal.

Page 146.—1. AO and BO are equal, and the line AB is bisected. 2. All the angles at O are equal— 90° each. CD is perpendicular to AB.

Page 147.—1. Triangles c, d, and f are acute; b and e are obtuse; a and g are right; d and e are isosceles; c is equilateral; a, b, f, and g are scalene.

Page 150.—1. $14\frac{1}{4}$. 2. $3\frac{1}{4}$. 3. 10. 4. $\frac{3}{4}$. 5. $7\frac{1}{2}$. 6. 2.3. 7. 43.64. 8. 7.555. 9. .8604. 10. 488. 11. 540. 12. 453. 13. 32. 14. $66\frac{2}{3}\%$. 15. 300. 16. 20% . 17. 1.08. 18. $.25\%$. 19. $\frac{3}{16}$, .3, or 30% . 20. 440 yd.; 2 pk. 21. 510. 22. 77,559. 23. 248,653. 24. 60,899. 25. 16 to 5, or $3\frac{1}{5}$; 5 to 16, or $\frac{5}{16}$.

Page 151.—Practice Test in Fractions V: 1. $1\frac{1}{6}$. 2. $19\frac{3}{4}$. 3. $79\frac{1}{5}$. 4. $6\frac{3}{11}$. 5. $1\frac{7}{20}$. 6. $7\frac{1}{2}$. 7. $\frac{15}{16}$. 8. $11\frac{2}{3}$. 9. $3\frac{15}{8}$. 10. $4\frac{1}{2}$. 11. $16\frac{5}{8}$. 12. $13\frac{3}{4}$.

Practice Test in Decimals IV: 1. 23.6. 2. 34.79. 3. 102.10. 4. 90.9. 5. 14.75. 6. 26.447. 7. .536. 8. .852. 9. 46.066. 10. .82. 11. 52. 12. 220.606. 13. $8.77\frac{1}{5}$. 14. $\frac{3}{4}$.

Practice Test in Per Cent III: 1. 50% ; 25% ; 120% ; $333\frac{1}{3}\%$. 2. 7.2; 4.5; \$.216, or \$.22; \$.60. 3. 43.75; 125; 112.5; 1,000. 4. 50% , 75% , 150% , $83\frac{1}{3}\%$. 5. 120; 80. 6. Twice. 7. .15; .125; .0025. 8. .3 is .05 more.

Page 152.—1. 10 in. 2. 7 ft. 3. $1\frac{1}{2}$ hr. 4. $129\frac{1}{6}$ sq. ft. 5. 10 gal. 3 qt. 6. 1 ft. 5 in. 7. $2\frac{1}{16}$ cu. ft. 8. 16 qt. 9. \$1.68. 10. $13\frac{1}{2}$ oz. 11. $18\frac{3}{4}$ min. 12. $46\frac{1}{3}$ ft.

Page 153.—Oral and constructions.

Page 154.—1. John's is 20 sq. rd. larger.

Page 155.—3. b, 9 sq. ft. 4. 240 A. 5. 13,500 sq. mi. 6. $48\frac{3}{4}$ sq. ft. 7. 3.375 sq. rd. 8. 19,200 sq. rd. 9. 540 sq. in. 10. 145.2 sq. yd.

Page 156.—13. A $\frac{7}{16}$ sq. in.; B $\frac{3}{4}$ sq. in.; C $\frac{27}{64}$ sq. in.; D $\frac{9}{32}$ sq. in.; A $\frac{9}{16}$ sq. in. less; B $\frac{1}{4}$ sq. in. less; C $\frac{37}{64}$ sq. in. less; D $\frac{33}{32}$ sq. in. less. 15. 36 sq. in.; 25 sq. in.; 100 sq. in.; 144 sq. in.; 9 sq. ft.; 16 sq. yd. 16. The area increases. 17. The area increases. 18. The area becomes 4 times as great. 19. The area may increase or it may decrease.

Page 157.—2. 9; 25; 100. 4. 625 sq. in.; 900 sq. in.; $2\frac{1}{4}$ sq. ft.; 6.25 sq. yd.; l = length and w = width.

Page 158.—7. 114 ft. 8. 272 in. 9. 46 mi. 10. 290 yd. 11. 240 rd. 12. 27 ft. 8 in. 15. 360 ft.

Page 159.—16. 840 ft.; 336 steps. 18. $3\frac{1}{16}$ in. 19. $4\frac{1}{2}$ in. 20. 22.625 ft. Square Roots: 1. 5 in. 2. 9 in. 3. 10 ft. 4. 1 mi. 5. 3 ft. 6. 11 yd. 7. 4 ft. 8. 6 yd. 9. 8 rd. 10. 13 in. 11. 14 ft. 12. 15 in. 13. 7; 12; $\frac{1}{2}$.

Page 160.—1. 26 ft. 2. \$6.50. 3. A, $2\frac{3}{4}$; B, $3\frac{1}{2}$ in.; C, 3 in.; D, $2\frac{1}{4}$ in. 4. $3\frac{1}{2}$ in. 5. 4 in.; 2.8 in.; 40 yd.; $3\frac{1}{3}$ in.; 46 yd.; 300 rd. 6. 20 posts. 8. $2\frac{1}{4}$ in.; $2\frac{3}{8}$ in.; 2 in.; $1\frac{1}{2}$ in.

Page 161.—1. 12 sq. in. 2. 12 sq. in. 3. 3,000 sq. rd., or $18\frac{3}{4}$ A. 4. 72 sq. in. 5. 96 sq. ft. 6. 24.75 sq. yd. 7. 560 sq. rd. 8. 980 sq. mi. 9. $43\frac{1}{8}$ sq. in. 10. $187\frac{1}{2}$ sq. ft.

Page 162.—1. 36 sq. in. 3. 40 sq. in. 4. It is $\frac{1}{2}$ the area.

Page 163.—6. 15,000 sq. ft.; \$1,500. 7. 42 sq. in. 8. 54 sq. ft. 9. $12\frac{3}{4}$ sq. yd. 10. 72 sq. yd. 11. 576 sq. rd. 12. 40 sq. yd. 13. $1\frac{1}{8}$ sq. ft. 14. 64 sq. mi. 15. $11\frac{1}{3}$ sq. ft. 16. 29.484375 sq. ft. 17. a, $\frac{1}{4}$ sq. in.; b, $\frac{33}{64}$ sq. in.; c, $\frac{33}{64}$ sq. in.; d, $\frac{3}{16}$ sq. in.

Page 164.—Over 720 revolutions. 2. 3.19; 3.19; 3.15. 3. 3.17.

Page 165.—6. 109.956 in., or 110 in. 7. 88 ft. 8. The one with a diameter of 3 ft. 9. \$3.67. 10. 7 ft. 11. 7 ft. 12. $50\frac{7}{8}$ ft. 13. 21 ft. 14. $1\frac{3}{4}$ ft. 15. $12\frac{8}{11}$ ft. 16. $8\frac{13}{32}$ ft. 17. $23\frac{1}{21}$ ft.

Page 166.—1. $314\frac{7}{8}$ sq. in. 2. $31,428\frac{7}{8}$ sq. ft. 3. The area of the square is 5.4 sq. ft. larger. 4. a, $50\frac{7}{8}$ sq. ft.; b, $7,857\frac{7}{8}$ sq. ft.; c, $17,687\frac{7}{8}$ sq. ft.; d, $707\frac{7}{8}$ sq. ft.; e, $201\frac{7}{8}$ sq. ft.

Page 167.—3. 192 cu. in.

Page 168.—4. 480 cu. ft. 5. 288 cu. in. 6. 210 cu. ft. 7. 864 cu. yd. 8. 108 cu. ft. 9. $236\frac{1}{4}$ cu. in. 10. 67.2 cu. ft. 11. 450 gal. 12. 1,728 cu. in. 13. 41,472 cu. in.

Measuring wood: 1. 108 cu. ft. 2. Yes. 3. $1\frac{1}{4}$ cords.

Page 169.—2. 64 cu. in.; 15.625 cu. ft.; $1\frac{3}{4}$ cu. yd.; $\frac{1}{8}$ cu. mi. 3. Cube is 16 cu. ft. greater. 5. 80 cu. in. 6. 98 cu. ft. 7. Cube is $3\frac{1}{2}$ cu. ft. greater.

Page 170.—10. $1\frac{1}{2}$ sq. in. 11. 3 sq. in. 12. Figure will be $2\frac{1}{2}$ " by 3".

Page 171.—1. Triangle. 2. $987\frac{3}{16}$ sq. ft. 3. 160 ft.; 140 ft. 4. 600 ft. 5. 14,400 sq. ft. 6. 1,875 gal. 7. $3\frac{5}{8}$ cords. 8. $10\frac{1}{2}$ sq. in. greater. 9. 120 times. 10. Yes, $31\frac{1}{4}$ gal. over. 11. 6,000 lb. 12. $\frac{3}{16}$ A. or 30 sq. rd. larger. 13. 48 in.

Page 172.—1. 11.65 persons; \$102,088.02. 2. 10.6%. 3. \$269.12. 4. 5%. 5. \$108,675. 6. $70.2\frac{+}{\%}$. 7. About $\frac{1}{6}$. 8. $\frac{7}{111}$. 9. \$4,215.

Page 173.—(1) \$3,844.25; (2) \$2,670.77; (3) \$10,314.72; (4) \$54.01; (5) .52%; (6) .52%.

Page 174.—1. $20\frac{3}{5}$. 2. $1\frac{9}{10}$. 3. $\frac{5}{8}$. 4. $\frac{5}{8}$. 5. 9. 6. 1. 7. 57.54. 8. \$425. 9. 12%. 10. 3.646. 11. 5,300. 12. .0045. 13. .653. 14. .836. 15. 20. 16. 20%. 17. 703. 18. $\frac{1}{2}$ or 50%. 19. .25. 20. 17.5 is twice as much as 8.75. 21. 10.18. 22. 341,418. 23. 77,778. 24. 29,229.

Page 175.—Six-minute Test: 1. 5,125. 2. 3,624. 3. 5,775. 4. 3,156. 5. 5,091. 6. 5,515.

Four-minute Test: 1. 2,321. 2. 4,425. 3. 1,999. 4. 3,063. 5. 408. 6. 9,997. 7. 9,797. 8. 656. 9. 7,898. 10. 769.

Eight-minute Test: 1. 416,010. 2. 563,568. 3. 254,745. 4. 4,187,325. 5. 504,375. 6. 7,472,840. 7. 19,662,500. 8. 34,373,166. 9. 67,850,754.

Page 176.—Eight-minute Test: 1. $67\frac{5}{8}$. 2. $68\frac{1}{3}$. 3. 305. 4. $200\frac{2}{3}$. 5. 2,004. 6. 2,010. 7. \$14. 8. $34\frac{9}{148}$. 9. 65.

Test in Fractions VI: 1. $1\frac{1}{5}$. 2. $17\frac{1}{4}$. 3. $\frac{1}{5}$. 4. $7\frac{2}{3}$. 5. $\frac{4}{5}$. 6. $1\frac{3}{8}$. 7. $22\frac{1}{2}$. 8. $16\frac{7}{12}$. 9. $2\frac{1}{15}$. 10. $1\frac{7}{15}$. 11. $11\frac{2}{5}$. 12. $1\frac{7}{12}$.

Test in Decimals V: 1. 2.3. 2. 1.55. 3. 101.8. 4. 37.375. 5. 86.97. 6. 18.525. 7. 2.4. 8. 3.375. 9. .0852. 10. 15. 11. 24.61. 12. 12. 13. .625. 14. 14.75.

Test in Percentage IV: 1. 50%; 75%; 50%; 60%; 145%; 37.5%; $112\frac{1}{2}\%$. 2. .08; 2.05; .18; .045; .002; .075. 3. \$58.80. 4. $33\frac{1}{3}\%$. 5. 200. 6. 500. 7. 300. 8. 125%. 9. 92%. 10. 184.

Page 178.—1. \$11.70. 2. \$36.40. 3. \$245.75. 4. \$151.80. 5. 22 lb. 6. \$60. 7. \$740. 8. \$5. 9. Rug costs \$2.50 less. 10. 45 cu. ft.

SECTION V

Page 179.—1. \$7.00; \$8.00; \$3.50; \$4.50. 2. \$18.00.

Page 180.—3. \$81. 5. \$48. 6. \$40. 7. \$56. 8. \$22. 9. \$32.50. 10. \$40.50. 11. \$78. 12. \$20.25. 13. \$38.43. 14. \$12.52. 15. \$438. 16. \$36.

Page 181.—2. \$8.00.

	INTEREST	AMOUNT		INTEREST	AMOUNT
3.	\$60	\$460	11.	\$15.75	\$915.75
4.	\$112	\$812	12.	\$48.75	\$698.75
5.	\$144	\$944	13.	\$72.50	\$797.50
6.	\$118.13	\$868.13	14.	\$37.50	\$537.50
7.	\$435	\$3,335	15.	\$75.00	\$675.00
8.	\$15	\$1,515	16.	\$14.25	\$964.25
9.	\$60	\$3,060	17.	\$160.00	\$4,160.00
10.	\$36	\$1,236	18.	\$28.80	\$568.80

19. \$24. 20. \$10. 21. \$7.50.

Page 182.—1. \$12. 2. 7%. 3. \$480.

4. I, \$50; A, \$1,050. 5. I, \$80; A, \$2,080. 6. 6%; A, \$1,060. 7. 5%; A, \$2,100. 8. R, 4%; I, \$40. 9. R, 10%; I, \$200. 10. P, \$3,000; A, \$3,210. 11. P, \$1,500; A, \$1,560. 12. P, \$1,500; A, \$1,575. 13. I, \$172.50; A, \$3,047.50. 14. R, 3%; A, \$3,708. 15. R, 4%; I, \$119. 16. P, \$5,800; A, \$5,974. 17. R, 5%; I, \$240.

Page 183.—1. 5%. 2. 6%. 3. 5%. 4. 2%. 5. 6%. 6. 4%. 7. $2\frac{1}{2}\%$. 8. 4%. 9. 5%. 10. 5%. 11. 6%. 12. 6%. 13. 6%. 14. \$500. 15. \$600. 16. \$500. 17. \$440. 18. \$300. 19. \$750. 20. \$240. 21. \$500. 22. \$600. 23. \$5,000. 24. \$2,000. 25. \$4,000. 26. \$2,000. 27. \$500. 28. \$500. 29. \$310. 30. \$186.

Page 184.—1. \$300; \$25. 2. \$6,000; \$6,000. 3. 8%; \$620. 4. 7%. 5. \$500. 6. \$1,500.

7. I, \$40; A, \$440. 8. I, \$21; A, \$621. 9. R, 4%; A, \$810. 10. R, 5%; A, \$920. 11. R, 4%; I, \$40. 12. R, 6%; I, \$135. 13. P, \$2,000; A, \$2,320. 14. P, \$148; A, \$162.80. 15. I, \$24; A, \$624. 16. R, 3%; A, \$812. 17. R, 4%; I, \$54. 18. P, \$3,000; A, \$3,360.

Page 185.—1. \$20. 2. 20 times. 3. \$21.34.

Page 186.—5. \$10. 6. \$10. 7. \$20. 8. \$12.50. 9. \$15. 10. \$20. 11. \$20. 12. \$20.

Finding the Cost of Insurance: 1. \$12.50. 2. \$7.20. 3. \$11. 4. \$23.25. 5. \$1.62. 6. \$1.30. 7. \$140. 8. \$232. 9. \$127.05. 10. \$528.90. 11. \$67.64. 12. \$8.00.

Page 187.—13. \$3.30. 14. \$5.50; \$1.10 less. 15. \$12; \$10; \$9.60. 16. \$28.80; \$24; \$23.04. 17. \$99; \$82.50; \$79.20.

Page 189.—Practice Test in Fractions IV: 1. $15\frac{2}{3}$. 2. $6\frac{5}{8}$. 3. $\frac{5}{8}$. 4. $7\frac{1}{2}$. 5. $4\frac{5}{8}$. 6. 7. $4\frac{7}{8}$. 8. $12\frac{2}{3}$. 9. $2\frac{4}{5}$. 10. $\frac{1}{3}$. 11. 3. 12. $11\frac{5}{12}$. Practice Test in Decimals III: 1. 18.3. 2. 24.89. 3. 114.32. 4. 58.8. 5. 5.09. 6. 5.252. 7. 1.53. 8. 33.3. 9. .4672. 10. 1.31. 11. 6.65. 12. 11.11. 13. $.833\frac{1}{3}$. 14. $7\frac{3}{8}$.

Practice Test in Percentage II: 1. 4%; $137\frac{1}{2}\%$; 20%; 210%; $112\frac{1}{2}\%$; $12\frac{1}{2}\%$. 2. .165; 1.18; .005; .0625; .03; 3. 3. \$28.80. 4. 80%. 5. \$640. 6. \$864. 7. 600. 8. 120%. 9. 6%. 10. 72.

Page 190.—1. $19\frac{5}{12}$. 2. $2\frac{1}{2}$. 3. $1\frac{3}{4}$. 4. $\frac{1}{3}$. 5. $1\frac{1}{6}$. 6. 2.2. 7. 89.475. 8. 3.25. 9. 4,760. 10. .0028. 11. .678. 12. .857. 13. .96. 14. 103.20. 15. 50%. 16. .4375. 17. \$120. 18. 135.365+. 19. $\frac{1}{4}$. 20. 60%. 23. 154 sq. in.; 27 sq. ft.; 5.4 sq. ft.; 16.65 sq. ft. 24. $112\frac{1}{2}$ cu. ft. 25. 15 ft. 26. 132 in. 28. 16%.

Page 191.—1. \$15. 2. \$1,440. 3. 4.473 mi. 4. 25 min. 5. \$20. 6. \$373.20. 7. \$235. 8. \$.016. 9. 25%. 10. \$1,041.25.

SECTION VI

Page 192.—1. Larger. 2. Southwestern Canada, central U. S., Argentina where dots are thickest. 3. No. 4. South (west and central).

Page 194.—1. Dotted line. 2. Solid line. 3. Grades 3, 4, 7, and 8. 4. Grades 5 and 6. 5. Gr. 3, 125; Gr. 4, 130; Gr. 5, 128; Gr. 6, 156; Gr. 7, 190; Gr. 8, 208. 7. Scores better in all grades except Grade 8.

Page 195.—1. 66°. 2. 69°. 3. 70°; 72°; 74°; 76°; 78°; 72°.

Page 196.—1. 725,000 mi. 2. Argentina, 30,000; British Isles, 32,000; Australia, 34,000; France, 36,000; India, 40,000; Canada, 42,000; Germany, 52,000; Russia, 52,000; United States, 265,000. 3. No. 4. United States has 213,000 more railroad mileage than Russia. 5. About 125%.

Page 198.—1. 60% were of normal weight. 3. 100%. 4. 40%. 5. Feed; cash expense; 100. 6. 14.3%. 7. \$1,928.25; \$189.00; \$90.00; \$15.75.

Page 199.—4. A, $\frac{1}{3}$; B, $\frac{2}{3}$; C, $\frac{1}{3}$; D, $\frac{1}{10}$; E, $\frac{1}{10}$. 5. B, 144°; C, 72°; D, 36°; E, 36°.

Page 200.—11. a, Circle D; b, Circle A; c, Circle B; d, Circle C.

Page 201.—1. 1901, 190 million; 1906, 300 million; 1911, 480 million; 1916, 530 million; 1921, 1,270 million; 1926, 1,000 million; 1931, 950 million. 3. 5"; 2 $\frac{1}{2}$ "; 6"; 7 $\frac{1}{2}$ ". 4. 1"; 2".

Page 203.—2. 71.2%. 3. \$42,579. 4. \$48,954,425.55. 6. Logs and bolts, 20%; pulp, 33 $\frac{1}{3}$ %; ties, 1 $\frac{1}{3}$ %; fuel, 40%; others, 5 $\frac{5}{9}$ %. 7. b, 22.5+%; c, about 11.5.

Page 205.—1. 15 $\frac{17}{20}$. 2. $\frac{9}{10}$. 3. 4 $\frac{1}{2}$. 4. $\frac{3}{4}$. 5. 1 $\frac{17}{28}$. 6. 2.2. 7. 25.109. 8. 9.125. 9. .3. 10. .11. 11. 2,500. 12. .0875. 13. \$54. 14. 40%. 15. .27 $\frac{7}{5}$. 16. \$45. 17. 706. 18. 85%. 19. $\frac{1}{2}$. 20. $\frac{1}{4}$, or 14 $\frac{3}{4}$ %. 21. 5.15. 22. 407,048. 23. 33,042. 24. 37,180. 25. 90°.

Page 206.

PRINCIPAL	RATE	TIME	INTEREST	AMOUNT
1. 450.....	5%	3 $\frac{1}{2}$ yr.	\$78.75	\$528.75
2. 500.....	10%	6 mo.	25.00	525.00
3. 400.....	8%	1 yr.	32.00	432.00

TOTAL SALES	RATE OF COMMISSION	COMMISSION	OTHER EXPENSES	NET PROCEEDS
4. \$1,000.....	2%	\$20.00	\$4.75	\$975.25
5. 4,200.....	3%	126.00	15.90	4,058.10
6. 10,000.....	2 $\frac{1}{2}$ %	250.00	8.78	9,741.22

MARKED PRICE	RATE OF DISCOUNT	DISCOUNT	SELLING PRICE
7. \$8.00.....	20%	\$1.60	\$6.40
8. 16.00.....	12 $\frac{1}{2}$ %	200.00	1,400.00
9. 84.00.....	4%	3.36	80.64

COST	OVER-HEAD	TOTAL COST	SALES PRICE	NET PROFIT	RATE
10. \$4.80.....	\$1.50	\$6.30	\$7.00	\$.70	10%
11. 25.40.....	10.60	36.00	40.00	4.00	10%
12. 38.24.....	7.51	45.75	60.00	14.25	23 $\frac{1}{4}$ %

SELLING PRICE	COST	GAIN OR LOSS	RATE
13. \$8.00.....	\$7.20	\$.80	10%
14. 14.40.....	12.00	2.40	20% gain
15. 21.60.....	24.00	2.40 loss	10%

SECTION VII

Page 208.—2. $a + b + c$. 3. $a - b$. 5. $4b$. 6. $2a + b$. 8. $\frac{x}{6}$.

9. $3s$. 10. $l - 6$. 11. $\frac{h}{4}$.

Page 209.—1. a'' ; b'' . 3. $x + y + z$; $m + n + o$; $a + b + c + d$.
5. $2a + b$; $4s + b$; $4s$; $2l + 2w$. 6. $3a$ cents. 7. $3l$. 8. $4a$.
9. $2w + l$. 10. $2w + 2l$. 11. $3a + b$. 12. $7a + x$.

Page 210.—2. $c + 6$; $c + 10$; $a + 15$. 4. $b + x$. 5. $x + y$. 6. $p + n$.
7. $a + i$. 8. $s + r$. 9. $4n$. 10. $x + \$1$. 11. $3t''$.

Page 211.—1. \$1.10. 3. $x - y$. 4. $a - b$. 5. $m - c$. 6. $l - i$.
7. $s - d$. 8. $a - p$. 9. $d - s$. 10. $p - r$. 11. $l - w$. 12. $n - 5$;
 $n - a$; $n - x$.

Page 212.—3. ac sq. ft. 4. ax sq. ft. 5. ad dollars. 6. sd dollars.
7. $4p$ lb.; $12p$; sp ; xp . 8. mt pounds. 9. xyz cu. ft. 10. $4x$ ft.
11. $(2x + 2y)$ ft. 12. $\frac{1}{2}ax$ sq. ft.

Page 213.—1. \$1.60. 2. $\frac{x}{10}$. 3. $\frac{x}{y}$. 4. $\frac{x}{5}$. 5. $\frac{y}{z}$. 6. $\frac{y}{x}$. 7. $\frac{x}{p}$. 8. $\frac{c}{s}$.
9. $\frac{n}{c}$. 10. $\frac{p}{n}$.

Page 214.—1. 108 in. 2. $12x$ in. 3. $12y$ in. 4. $3y$ ft. 5. $36y$ in.
6. $320x$ rd. 7. $2x$ pt. 8. $4z$ qt. 9. $60n$ min. 10. $60s$ sec. 11. $10x$
dimes. 12. $20d$ nickels. 13. $16p$ oz. 14. $20t$ cwt. 15. $12n$ mo.
16. $27c$ cu. ft. 17. $144r$ sq. in. 18. $160b$ sq. rd. 20. $\frac{y}{12}$. 21. $\frac{y}{36}$.
22. $\frac{x}{3}$. 23. $\frac{r}{320}$. 24. $\frac{p}{2}$. 25. $\frac{p}{8}$. 26. $\frac{r}{60}$. 27. $\frac{d}{10}$. 28. $\frac{q}{16}$. 29. $\frac{x}{100}$.
30. $\frac{n}{12}$. 31. $\frac{y}{1728}$. 32. $\frac{x}{60} + y$. 33. $4b + \frac{c}{2}$.

Page 215. 2. 10. 3. 6. 4. 9. 5. 3. 6. 2. 7. 7. 8. 3. 9. 4.
10. 5 in. 11. 3 in. 12. $3\frac{1}{2}$ ft. 13. 120 sq. in. 14. 6 in. 15. $5\frac{1}{2}$ ft.
16. 5 yd. 17. 16 rd. 18. 100 rd.

Page 216.—2. 5. 3. $x + 4 = 9$. 4. $x + 5 = 16$. 5. $p + \$40 = \$440$.
6. $a, 3$; $b, 1\frac{1}{2}$; $c, 18$. 7. $a, 4$; $b, \frac{1}{2}$; $c, 2$. 8. $a, 5$; $b, 1\frac{1}{2}$; $c, 1\frac{1}{2}$. 9. $a, 9$;
 $b, 12\frac{1}{2}$; $c, 4$.

Page 217.—2. 9. 3. 9. 4. 15. 5. 12. 6. 19. 7. 19. 8. 17. 9. 40.
10. 3. 11. 3. 12. $7\frac{1}{2}$. 13. $12\frac{1}{2}$. 14. 4. 15. 9. 16. 10. 17. $x - 4 = 7$;
11. 18. $x - 5 = 9$; 14. 19. $s - \$2.50 = \$10$; $\$12.50$. 20. $a - \$3.50 =$
 $\$160.50$; $\$164$. 21. $c - \$18 = \$3$; $\$21$. 22. $c + \$3 = \$16$; $\$13$.
23. $p + \$16 = \$176$; $\$160$. 24. $4s = 48$; 12. 25. $3s = 36$; 12.
26. $2i = \$70$; $\$35$. 27. $c - \$3 = \$6$; $\$9$. 28. $s - \$12 = \$188$; $\$200$.
29. $a - \$1,750 = \$187.50$; $\$1,937.50$.

Page 218.—2. 24. 3. 12. 4. 36. 5. 36. 6. 45. 7. 6. 8. 32.
9. 24. 10. 48. 11. 8. 12. 6. 13. 8. 14. 4. 15. 8. 16. 7. 17. $\frac{x}{2} = 4$;
8. 18. $\frac{x}{4} = 12$; 48. 19. $\frac{p}{4} = \$25$; $\$1.00$. 20. $\frac{p}{3} = \$7.50$; $\$22.50$.

Page 219.—Set I: 1. $a, 3$; $b, 3$; $c, 2$. 2. $a, 2$; $b, 2$; $c, 6$. 3. $a, 7$;
 $b, 8$; $c, 9$. 4. $a, 32$; $b, 6$; $c, 15$.

Set II: 1. $a, 4$; $b, 8$; $c, 7$. 2. $a, 10$; $b, 13$; $c, 4$. 3. $a, 8$; $b, 11$; $c, 8\frac{1}{2}$.
4. $a, 10$; $b, 13\frac{1}{2}$; $c, 12\frac{1}{2}$.

Set III: 1. $a, 4$; $b, 12$; $c, 5$. 2. $a, 5$; $b, 15$; $c, 13$. 3. $a, 12$; $b, 14$;
 $c, 2\frac{1}{2}$. 4. $a, 7$; $b, 4$; $c, 5$.

Using Formulas: 1. Area of rectangle. 2. Area of triangle. 3. Volume
of rectangular solid. 4. Area of circle. 5. Circumference of circle.
6. Area of rectangle. 7. Perimeter of square. 8. Perimeter of rectangle.

Page 220.—Addition: 1. 3,747. 2. 3,901. 3. 3,692. 4. 4,071.
5. 2,436. 6. 4,461.

Subtraction: 1. 4,885. 2. 5,034. 3. 4,855. 4. 7,476. 5. 3,025.
6. 7,688. 7. 5,977. 8. 6,563. 9. 3,443. 10. 2,665. 11. 2,621.
12. 2,777.

Multiplication: 1. 29,230. 2. 7,532. 3. 16,647. 4. 41,160.
5. 293,568. 6. 18,265. 7. 12,054. 8. 10,452. 9. 12,596. 10. 177,424.
11. 478,676. 12. 165,006.

Page 221.—Division: 1. 357. 2. 319. 3. 731. 4. 941. 5. 385.
6. 274. 7. 508. 8. 956.

Test in Fractions VII: 1. $10\frac{2}{5}$. 2. $11\frac{7}{8}$. 3. $17\frac{1}{10}$. 4. $11\frac{2}{5}$. 5. $13\frac{3}{4}$.
6. $34\frac{3}{4}$. 7. $4\frac{7}{8}$. 8. $21\frac{1}{3}$. 9. $4\frac{5}{8}$. 10. $2\frac{5}{8}$. 11. $\frac{6}{25}$. 12. 70.

Test in Decimals VI: 1. 22.8. 2. 61.18. 3. 18.64. 4. 72.7. 5. 58.98.
6. 6.275. 7. 8.48. 8. 10. 9. 1.791. 10. 9.6. 11. 15. 12. 818.3+.
13. 8.8. 14. $\frac{7}{8}$.

Page 222.—1. $16\frac{2}{3}\%$; 50% ; 400% ; $162\frac{1}{2}\%$; $.4\%$; 135% . 2. .02;
.035; 1.25; .38; .005; .5. 3. \$100. 4. 45% . 5. 66,000. 6. 320. 7. 48.
8. $41\frac{2}{3}\%$. 9. 576. 10. 150% .

Finding Missing Numbers: 1. $a, 640$ sq. ft.; $b, 6$ in.; $c, 4$ rd. 2. $a, 60$
cu. in.; $b, 10$ ft.; $c, 6$ yd.

Page 223.—Cumulative Test VII: 1. $10\frac{1}{6}$. 2. 420. 3. $\frac{3}{4}$ or .75. 4. $\frac{7}{8}$.
5. 2. 6. 96. 7. 14.28. 8. 2.7. 9. .042. 10. .27. 11. \$.26. 12. 25% .
13. 150. 14. $13\frac{1}{3}$. 15. .0025. 16. 323.889. 17. 1.009. 18. 29.24.
19. 125% . 20. 250 lb.; 2 pt. 21. 338. 22. 319,982. 23. 6,575.
24. 6,622. 25. $3\frac{3}{4}$ is $\frac{1}{3}$ of $11\frac{1}{4}$.

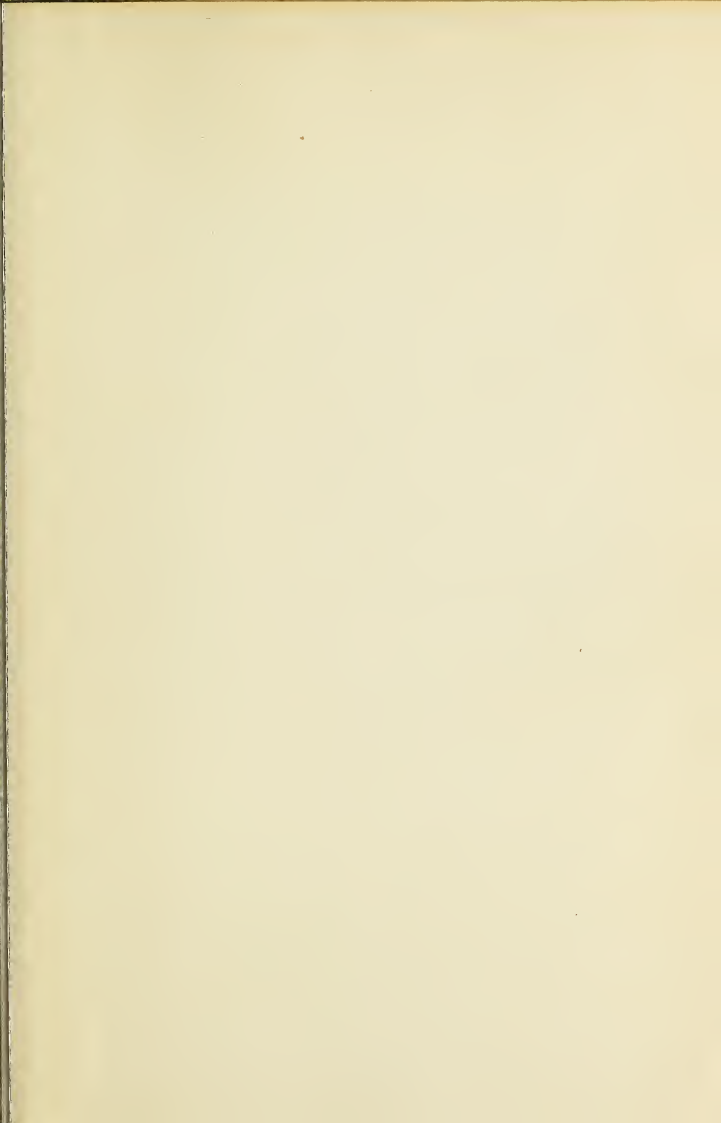
Page 224.—1. 40¢. 2. \$30. 3. \$36. 4. 20,000 mi. 5. 10% . 6. 384 ft.

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